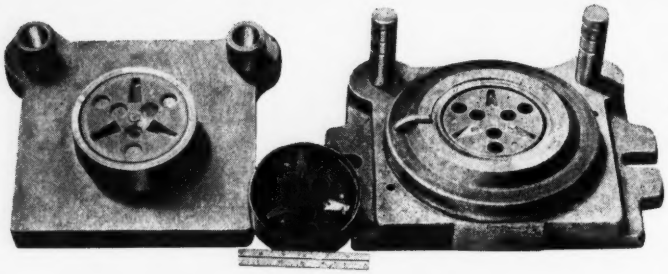

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This is only one of the many types of standardized die sets carried in stock at all Danly assembly plants—ready for immediate delivery.

This type is available in 52 sizes of die space with punch and die holders of six different thicknesses each.

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The 7th edition of the Danly Catalogue will be off the press February 1st. Greatly improved, this book should be in the hands of every designer, tool room superintendent and production manager. Ask for your copy.

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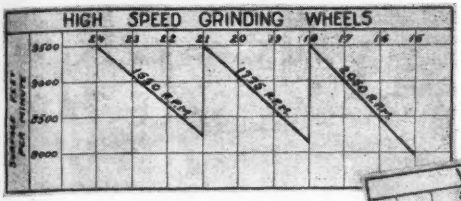

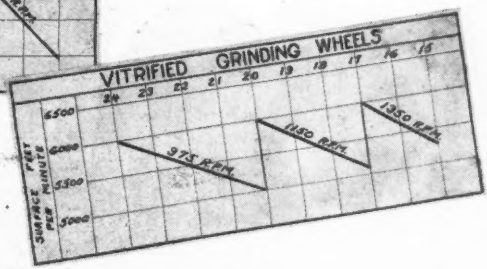

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Maintains Efficient Grinding Speeds with High Speed or Vitrified Wheels

THE most efficient grinding wheel speeds can now be readily maintained on Hisey TexDrive Grinders. As the wheel wears, the spindle speed is increased in proportion. The operator makes the proper spindle speed changes as he moves the guard to conform with wheel wear.

The Hisey Multi-Speed Grinder. When the 24-inch wheels are worn down to 20 inches (at this size they approach the low point of the efficient speed range), the belts are changed to the high speed pulleys so that the wheels again operate at the high point of the efficient speed range. This operation is repeated when the wheels are worn to 18 inches.

The Hisey System of Wheel Transfer is recommended where Hisey TexDrive Single-speed Grinders are used in banks of three. The plan is to transfer the wheels, when worn to a certain diameter, to a second grinder. The spindle of this machine, which is equipped with a smaller motor, operates at a higher speed—securing again the high point of the efficient speed range. As the wheel is worn to the next smaller diameter, it is transferred to a grinder equipped with a still smaller motor which operates the spindle at an even greater speed—once more obtaining the efficient grinding speed. *Write for Catalog 45*

THE HISEY-WOLF MACHINE CO.

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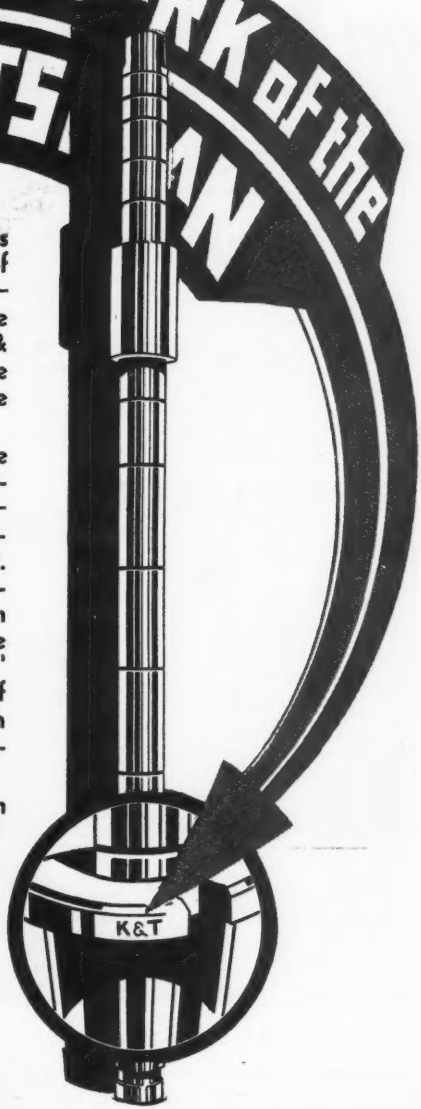

JUST as the artist affixes his name to his completed canvas as a final gesture of approval, so are the initials—"K&T"—stamped deeply into the rim of the driving collar of every Kearney & Trecker Arbor, as the mark of the craftsman who takes keen personal pride in his handiwork.

Through the many operations in the manufacture of K&T Arbors each workman has but one thought in mind—"accuracy first." Without skilled workmanship extreme accuracy cannot result. . . . Fine material is, of course, important and "K&T" quality has been established through years of experience in the milling field. Special "K&T" heat-treatment in salt bath furnaces of our own design assures maximum strength and toughness without sacrificing accuracy. . .

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KEARNEY & TRECKER
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MECHANICAL LAPPING—

Now a Standard Machining Operation

The final finish and accuracy which is demanded on such parts as are shown here can be obtained economically on a manufacturing basis only by

MACHINE LAPPING

Machine Lapped Bearing Surfaces have a minimum of friction and consequently:

1. Wear longer without reduction in size.
2. Have less risk of seizure.
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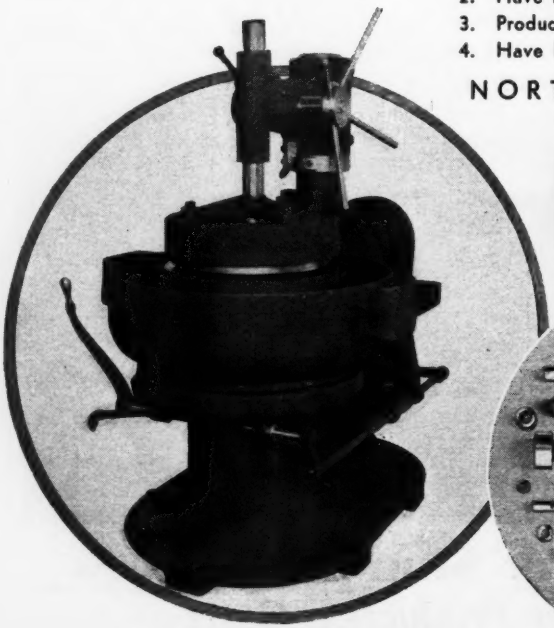
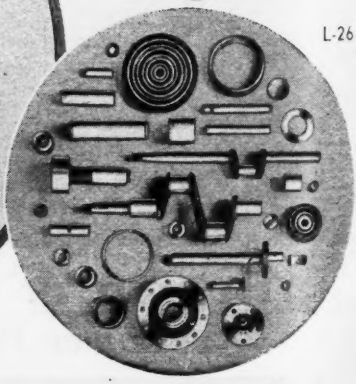


NORTON
LAPPING MACHINES



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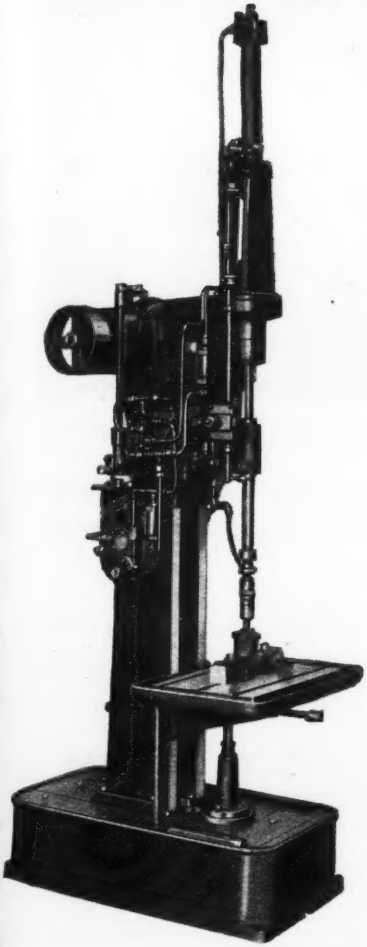

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MODERN Machine Shop
REG. U. S. PAT. OFF.
A Magazine for Machine Shop Executives
HOWARD CAMPBELL, Editor

Vol. 3 FEBRUARY, 1931 No. 9

CONTENTS

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MODERN Machine Shop

FEBRUARY, 1931

CINCINNATI, OHIO VOL. 3, NO. 9

Building the "Intertype"

Manufacturing Operations In the Production of the Modern Typesetting Machine

By HOWARD CAMPBELL

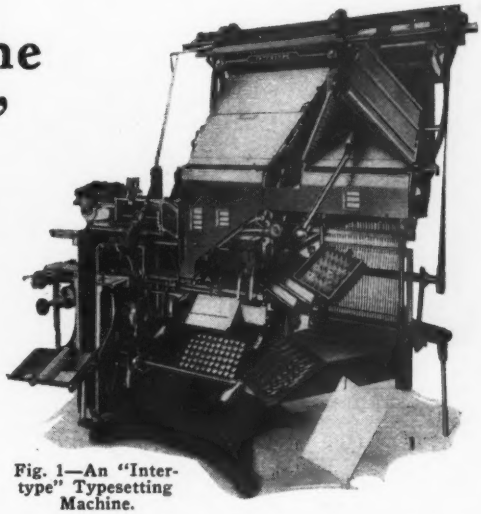


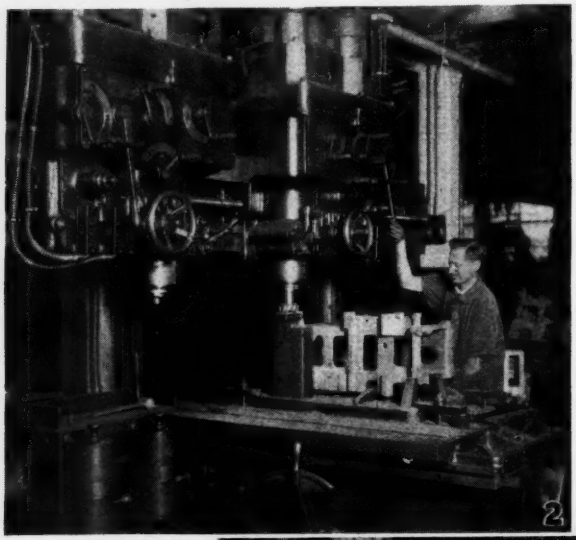
Fig. 1—An "Intertype" Typesetting Machine.

IF any single mechanical unit were to be selected as a symbol of this "machine age," the modern typesetting machine should receive first consideration. Our modern compositor sits before a keyboard which resembles that of a typewriter and sets type by the simple process of touching the keys. Actually, he sets a line of small brass molds, called "matrices," into which the molten type-metal is automatically poured, producing a complete line of type as a casting, or "slug."

After the casting process has taken place, the slug is ejected onto the galley at the left of the keyboard and the individual matrices are automatically distributed to the proper channels in the magazine from which they started. The entire operation is automatic after the characters have been selected with the exception that the operator, by means of a lever, raises the line of matrices into position for the casting process. The manufacture of the "Intertype" typesetting machine involves a series of interesting operations, several of which are described here.

The heavier castings, such as the base and column of the machine, are finished on special milling machines such as that shown in Fig. 2. Several surfaces of various heights are machined at a setting, a set-block being provided at the corner of the fixture

to aid in locating the cutters at the correct height. The set-block has two steps, providing for two settings.



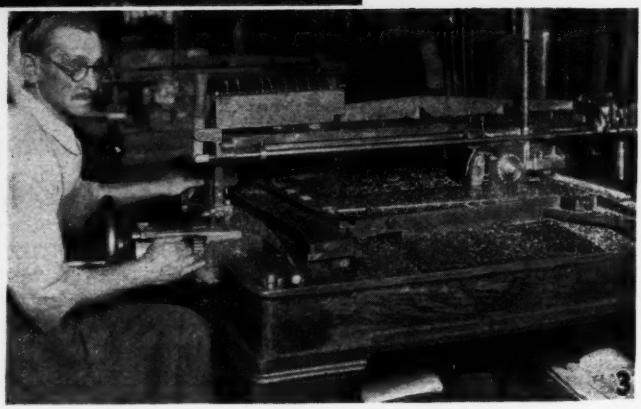
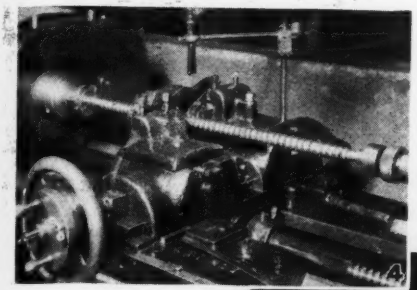


Fig. 2 — Machining the column. Note the two-step "set-block" at the corner of the fixture. Fig. 3—Milling the channels in the bottom-plate of the magazine.

The cutting edges of the cutters are not allowed to rest on the set-blocks, however; they are lowered to a point at which the "go" end of a "go-and-no-go" feeler can be inserted between the cutter and the block, then they are locked in position.

The magazine in which the matrices are held, ready for use, consists primarily of two grooved sheets of brass, which form the bottom and top plates. Each matrix, as it is released from the magazine by the operation of a corresponding key on the keyboard, must drop in the correct position and right end up, therefore it is necessary that the correct position of the matrix be maintained throughout the complete cycle of operation. This is accomplished by providing a slot in the magazine for each of the various characters, just wide enough for the matrix. These slots are milled into the plates of the magazine with the aid of the machine shown in Fig. 3. The plates are clamped to a table that swings on a slight radius so that the slots are farther apart at the receiving end than at the discharging end of the magazine, and the slots are milled in by means of a cutter which feeds automatically the full length of the plate, then reverses and moves

back to the starting end. A guide-pin, controlled by the operator's left hand, locates the plate for each slot by dropping into a corresponding hole in the end of the table. The plate shown in process will contain 90 slots of 10 different sizes from 0.040 in. wide to 0.110 in. wide.



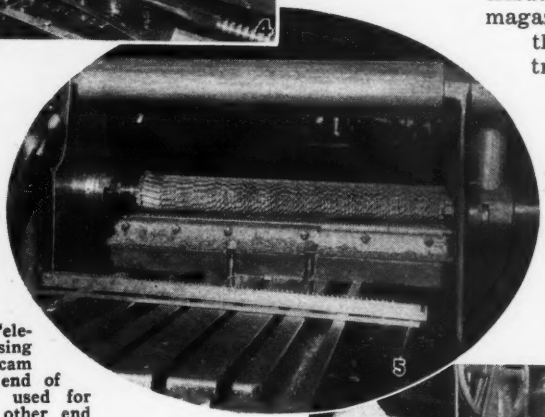
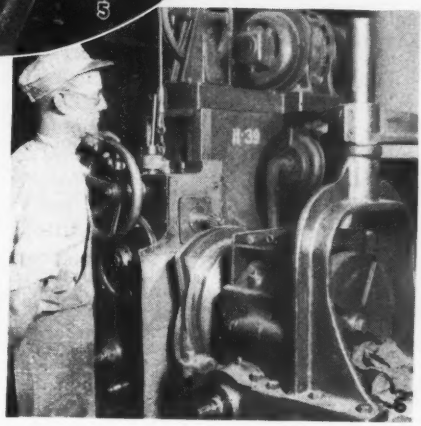


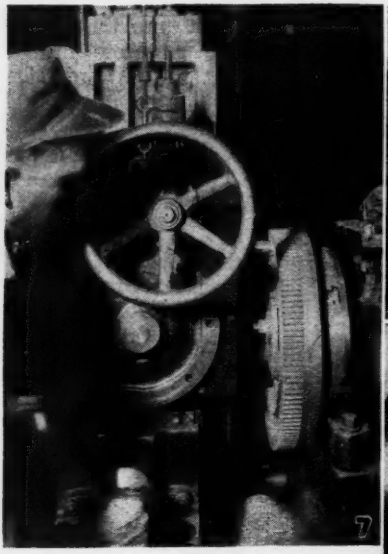
Fig. 4—Milling the square thread on the distributor conveyor-screw. Fig. 5—This gang of 95 high speed steel cutters slots the side of the channel entrance stopping bar.* Fig. 6—Milling contour of "elevator" cam, using Rowbottom cam miller. One end of the cutter is used for roughing, the other end for finishing.

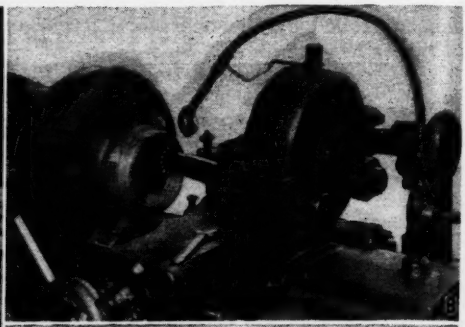
Immediately after the line of type has been cast, the corresponding line of matrices and spacebands is moved up to a point where it can be picked up by a long arm called an elevator, and the matrices are placed on a distributor bar to be distributed to their respective slots in the magazine. This distribution is accomplished by means of a conveyor screw which moves the matrices along on the bar until they reach their proper slots, at which point each drops off into the magazine. The conveyor screw has a square thread that is 0.237 in. wide by ⅛ in. deep, cut on the automatic threading lathe shown in operation in Fig. 4. The screw is 1 in. diameter and 43 in. long, and the thread-cutting operation is completed in 18 minutes.

As the matrices drop from the distributor bar into the magazine they pass the channel entrance automatic stopping bar, which is slotted to correspond to the channels in the magazine. The slotting operation on this stopping bar is performed with the equipment shown in Fig. 5, which is a milling machine and a gang of 95 high speed steel slotting cutters. The cutters are 3 in. in



This illustration courtesy Union Twist Drill Co.





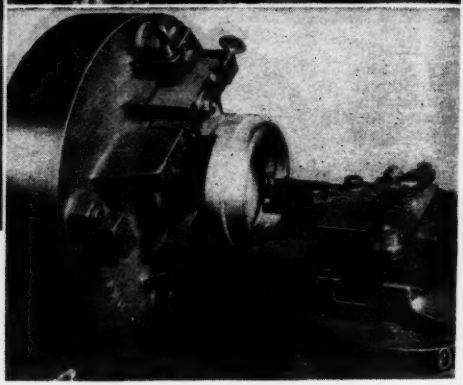
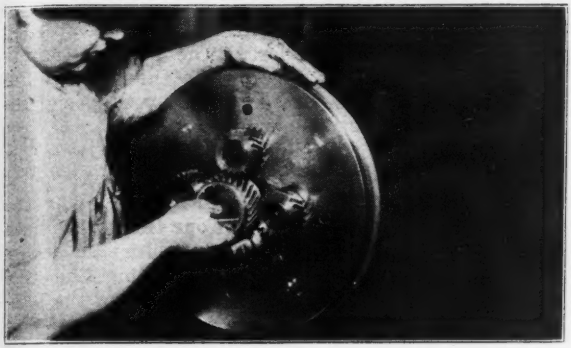


Fig. 7—Milling cam groove in mold cam and driving gear. Fig. 8—Roughing out triple thread in knife-block, using a Pratt & Whitney thread miller. Fig. 9—The thread is finished with a single-point tool. The tool can be set to any one of three positions, to cut each of the three threads.

diameter and the total length of the gang is 25 27/64 in. The total error allowable on the entire bar is plus or minus 0.002 in. When this operation was first set up, a considerable amount of difficulty was experienced in getting such a long set of cutters, all cutting at once, to perform properly. The problem was solved by setting the fixture at an angle of ½ degree to the center line of the arbor so that the cutters do not all start cutting at the same time. Each cutter follows in after the cutter next to it and thus the cutters at one end of the arbor are practically through as the cutters at the opposite end start cutting. The error caused by setting the fixture at an angle is so slight as to be of no consequence. A finished bar is shown lying across the table of the machine.

The mechanism which carries the matrices from casting position to the point where they are elevated to the distributor is controlled by a cam mechanism. The contour of the cam is milled on the Rowbottom cam miller shown in operation in Fig. 6, the same cutter being used for roughing and finishing operations. The cam is of cast iron, alloyed with a small amount of nickel and chromium to give it long-wearing qualities. From ⅛ to $\frac{5}{16}$ in. of stock is removed in the roughing operation and approximately 0.015 in. in the finishing operation, one-half of the cutter being used for roughing and the other half for finishing. After roughing, the cutter-



Operator simply screws gear into chuck, with wrench, against chuck body. Continued turning rotates chuck members, locating gear accurately in relation to pitch line of teeth, and holds gear securely for grinding or other operation. Chucking time, 4-6 seconds.

Garrison-made chucks for helicals; Sykes and built-up herringbones; spurs, bevels, worms, worm-wheels, sprockets, or for any part having teeth or threads. They can be used for grinding, diamond and single-point boring, reaming, re-machining, etc.

Garrison-made Gear Chucks are unexcelled for reliability, accuracy, speed and simplicity

CHUCKS for any type gear can be purchased for less than make-shift equipment can be designed and built. Garrison-made Gear Chucks eliminate "rejects." They increase the production of each machine and operator, and lower production costs.

Garrison is the only exclusive manufacturer of gear chucks, and Garrison-made patented Chucks have for many years been acknowledged superior from the standpoint of reliability and long-lived accuracy under hard use. They are less expensive in first cost and upkeep—due to volume of business, standardization and simplicity of design.

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By.....Title.....

arbor is moved out to bring the second half of the cutter into position.

In Fig. 7 is shown the operation of milling the cam groove in the mold cam and driving gear by which the casting mechanism is operated. The groove is ⅝ in. deep, and is roughed out first with a cutter of 1¼ in. diameter, then finished with a 1½ in. diameter cutter. The operation is completed, floor to floor, in 42 minutes.

As the slug leaves the mold, it passes a pair of knives which trim it to the necessary thickness within 0.001 in. The knives are controlled by a "knife-block" which consists primarily of a cylindrical piece such as that shown in the machine in Fig. 8. The piece contains a 2/3 P. triple thread which is first rough-milled, as shown here, in a Pratt & Whitney thread miller. The locating points for the start of the three individual threads are obtained by a special indexing head.

After rough milling, the thread is finished in a lathe with a single point tool as shown in Fig. 9. After the proper setting for one thread has been obtained, the settings for the others are obtained by adjusting the tool forward or back by means of the handle on the top of the tool block. This handle carries a locating pin which can be dropped into any one of the three holes, thus locating the tool in each of three positions.

(To be continued in the March issue.)

For the Shop Note-Book

By CHARLES R. WHITEHOUSE

TO prevent paint from peeling off from galvanized pipes, generators, and so on, first paint with a solution made as follows: Dissolve two ounces each of copper chloride, copper nitrate, and sal ammoniac in one gallon of soft water in an earthen or other acid-proof container, and add two ounces of commercial muriatic acid. Allow the solution to dry thoroughly into the surface to be painted, then apply the paint. It will stay on indefinitely without danger of cracking or peeling, under all conditions.

The modern trend in factories and offices is toward the use of colors instead of aluminum or bronze paint for painting steam pipes and radiators. The ordinary types of paints, however, often change color when heated. To make sure that the color will not change when the pipes are heated, first make sure that the surface to be painted is free from rust, scale, or grease, and then paint the pipes or radiators while warm. If painted while cold, the paint will blister or peel when the heat is turned on. Where white is used, do not use a paint containing white lead, but use zinc white only. For black, use ivory black, and for tints, use paints that have zinc white for a base. Yellow ochre, sienna raw and burnt, burnt umber, Venetian red, ultra-marine blue, and zinc yellow are the only pigments that will not change color when used on heated surfaces.

An excellent pipe joint cement can be made as follows: Special zinc dust, 12¼ lb., double boiled oil, 3 lb., dry mago, ¾ lb. The oil is first heated to a near-boiling temperature in an iron or steel container, then the mago is stirred into the oil. Stir thoroughly, then stir in the zinc dust in the same manner. When this mixture has cooled enough to "set," which should take about 24 hours, it is ready to use. The mixture is not only much stronger than the ordinary commercial cements, but it is also much cheaper.

MAINTAINED *between* TOOL GRINDS

Sunoco will protect the finished work from rust and corrosion, is perfect in its emulsion; will not separate. It is hygienic and will not become rancid after prolonged use.

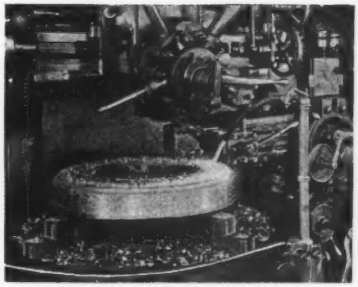
These are the reasons why leaders in the metal cutting industry recognize the value of Sunoco in producing better work at increased output per machine unit.

The Sun Oil Company offers assistance in solving individual metal cutting problems through the services of Cutting Oil Engineers who have had wide experience in the study of cutting oils and their application.

Write any of our many branches, or to our home office.

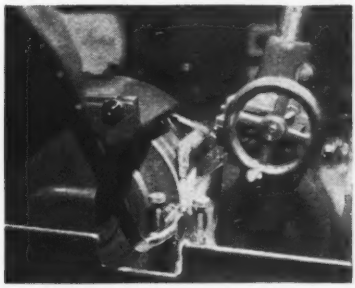
The Sun Oil Company produces a type of cutting oil to meet every metal cutting requirement.

Courtesy of Philadelphia Gear Works, Philadelphia, Pa.



OPERATION: TURNING AND FACING BEVEL GEAR BLANK.
MACHINE: BULLARD VERTICAL TURRET LATHE.
MATERIAL: DUPLEX GEAR STEEL NO. 1.
CUT: ¾ IN. FACING—⅛ IN. TURNING, O. D.
FEED: ⅛ IN.
SPEED: 4.2 S.F.P.M.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.

Courtesy of Cincinnati Grinders, Inc., Cincinnati, Ohio



PART NAME: PISTON PIN.
MACHINE: CINCINNATI CENTERLESS GRINDER.
MATERIAL: HARDENED STEEL.
LIMITS:
ROUND WITHIN . . . . . .00005 IN.
STRAIGHT . . . . . .00005 IN.
SIZE . . . . . .0001 IN.
STOCK REMOVED: .001 IN.
PRODUCTION RATE: 28 PER MINUTE.
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER.

SUN OIL COMPANY, Ltd., Montreal, Canada.

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CUTTING OIL
of BLUE SUNOCO MOTOR FUEL

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Making Payrolls Check With Costs

A System Which Provides Accurate Cost and Production Figures

By J. J. BERLINER, C.B.S.
Senior Member, National Accounting Systems

TO find the best system for calculating costs and payrolls in the average manufacturing plant, it is usually necessary to analyze the particular conditions involved and design a system to fit them. The common fault of many of the methods in use is that, at the end of the pay period, the accounts shown on the cost ledger do not balance with those shown on the payroll ledger. A discrepancy is nearly always in evidence, and many a cost clerk has burned the midnight oil trying to get the balance within the usual $10 limit. Efforts have been made to overcome this condition by the development of many more or less elaborate cost systems.

The system described in this article is being used in a number of plants, both large and small, and is invaluable for providing an exact check. In fact, the balance must be made to a cent, before the day's business can be closed. The principal feature of the system is the 4 x 6-in. service ticket shown in the illustration. The ticket is printed in triplicate, two carbon copies being made at the time the ticket is filled in. The

SERVICE CARD

Department No.	Machine No.	Move to	Order No.
Man No.	Man's Name		Account No.
Operation Name			Part No.
			Operation No.

Wanted	Total Hours	Time	Time	Time	Time
Finished	Wage Rate	Quit			
Good	Cost	Start			
Bad	Replace	Elapse			
Balance Due	Inspected by	Quit			
Name of Article		Start			
		Elapse			

THE CARD THAT INSURES ACCURACY

The history of the time spent on a job is condensed on this card. Clerical errors are the only ones that can creep in and they can be quickly caught.

original copy is used to make up the payroll, the duplicate copy to figure costs by orders, and the triplicate is given to the workman as an instruction card at the time he starts on the job. The card is largely self-explanatory, although some of the directions may not be clear to the reader at first glance.

At the top of the form are spaces for the Department Number and Machine Number where the operation is to be performed, also the number of the operator and his name. Just below these are the Part Number, Operation Number, and Name of the Operation. The name and number of the operation are taken from a standard operation book, if the job is a regular production job, or from instructions from the foreman, if it is a special or "one-time" job. Under "Move To" is entered the number of the department or machine to which the material is to be moved when the present operation is finished.

At the right is a space for the "Order No." to which the labor and material on this job are to be charged. If the workman is engaged on work of an unproductive nature which cannot be charged directly to a shop order, the charge is entered in the space marked "Account No."

Under "Wanted" is listed the quantity called for by the order, or the quantity of good pieces that must be finished. The number of pieces finished by the workman and passed by the inspector is noted under "Good," while the number rejected by the inspector is entered as "Bad." Under "Replace" is listed the number that must be refinished by the workman to complete the number called for on the order. "Balance Due" shows the number of pieces that remain uncompleted at the end of the pay period, when the card is closed out, or the number that remain uncompleted in case the workman is obliged to change to another job that may be more important.

The spaces in the lower right hand portion of the card show the number of hours worked on that particular job or order. There are 12 spaces provided on the card. The reason for this is that the card has been designed for a plant that pays its employees once a week. The card is, therefore, intended to cover a week's work, provided the job lasts a week. If the job is so large that it will last longer than a week, the card is closed out at the end of the week and a continuation card is made out to carry the job on into the next week, the information on the continuation card being copied from the original card and the continuation card being stamped "CONTINUATION." Whenever a job is completed, the card for that job is filed away in a "completed" file until the end of the week.

Two spaces are provided for each day, in order to provide for changes to rush work. When the workman goes back to a job that he had been working on previously, the original card for the job is used again. If an entirely different workman finishes the job, a new card is made out for the new operator. Two points to be remembered concerning the operation of this system are that (1) a card is made out for each operation, and (2) a card is made out for each workman. Under "Total Hours" is listed the total time spent by one workman on that job during the week. "Cost" is the total of wages paid the workman on that order.

A work order for each job is issued by the order department, a copy being made for each department in which work on this order is to be done. The department copy is sent directly to the department clerk to furnish him with the necessary in-

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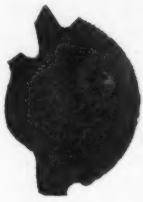
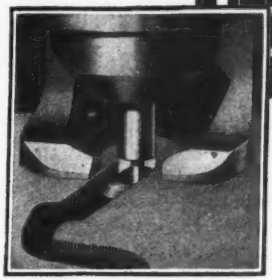


"It saves 75% of our time. If we could not get another Campbell Nibbling Machine," says Mr. E. J. Ashley, "we would not dispose of the one we have for two or three times what we paid for it—because it has paid for itself two or three times since we bought it."

The Steel & Johnson Mfg. Co. uses the Campbell Nibbling Machine cutting out cans and stripper plates, also all manner of shapes from brass, iron and steel up to ⅜" thick.



How the Campbell Nibbling Machine operates . . . .

The "close-up" shown at the right illustrates how the Campbell Nibbling Machine "nibbles" a narrow lane — each stroke of the punch cuts a small crescent-shaped chip—leaving a comparatively smooth edge. Internal or external designs can be cut 40 to 60 times as fast as drilling.

Campbell Nibbling Machines are made in sizes to handle stock up to ⅝" thick. Sheet steel, chrome nickel alloys, as well as many composition materials such as Bakelite and celluloid are quickly and easily cut.

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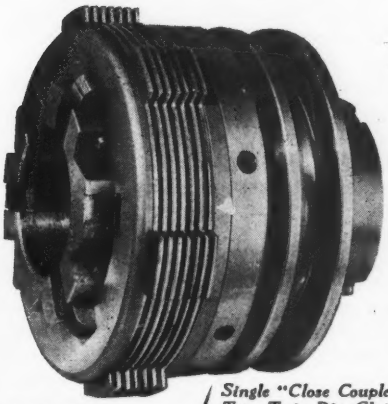
formation so that he can make out the service cards. He then makes out a job service card for each operation to be performed in that department and places it in the continuation file by order number until such time as he takes it out and starts a workman on the operation, at which time he stamps or marks the starting time on the card.

The shop or department clerk has a desk to which is attached a square "board" that has as many wire pockets as there are operators in the department, the number of each machine or bench being plainly inscribed over the individual pockets. Spring clips may be used instead of pockets, if desired, or the service cards may be filed in a desk card file. The board is much better, however, as it provides for instant selection of the ticket when a change is to be made, and thus eliminates delays. An additional advantage is provided in that the clerk, foreman, or other official may see at a glance what jobs are in process, what machines they are assigned to, and whether or not all the machines are in operation. In fact, there are a number of advantages to be gained by having the cards for all jobs in process out where they can be scanned at a glance. For instance, a service card can be placed on the board, under a certain machine number and just back of the service card for the job in process, with instructions to the clerk that the second card is for the job following on that machine, thus making it unnecessary for the workman to hunt up the foreman for instructions when the job in process is completed. In many cases all operations of certain types are performed on certain machines that are especially built or adapted for such work or where the operator is particularly suited for the work to be done and the clerk soon learns that these operations must of necessity be listed for the machines referred to. Thus the clerk can assume a larger part of the detail work and leave the foreman more time for the more important of his duties. At the end of each day the workmen drop their service cards into a pocket which indicates that the jobs upon which they were working were still in process at quitting time, making it possible for the clerk to make the proper notations, check the service card with the time card and return the cards the next morning.

The time clock card shows the time at which the workman entered and left the plant, and for which he is to be paid. The time card must, however, tally absolutely with the total time of each workman as shown by the service cards for each day, thus providing an accurate check on the time put in, amount of time allotted to each job, and costs. If the time card for a given workman shows that he entered the plant on time, the job service card is stamped O. O. If the time card shows that he was a half-hour late, the starting time is stamped on the service card as O. 5 and the card is stamped "LATE," in red letters, to show that the workman is to be docked a half-hour's pay and that no costs are to be recorded against this job for this half-hour.

Whenever the workman changes his job for a new one, the finishing time for the old job is stamped on the service card for that job and the same time is recorded as the starting time on the service card for the new job. If, for example, a workman has spent 4½ hours on a job, both the stopping time on the old card and the starting time on the new one will be stamped 4.5. This method of procedure is used each time the job is changed throughout the day, until the full day's time has been accounted for. Thus, bar-



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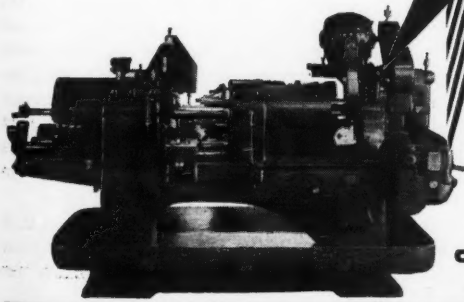
In the model M 4 Cleveland spindle bar machine shown, a Twin Disc Clutch is used in the feed bracket to facilitate the machine's fast and slow motion. The fast motion is used in indexing the spindle turret, feeding the stock and advancing the tools to the work. When the tools reach the cutting position, the clutch is shifted to engage the slow motion on the working feed of the tools. And, in addition, the power clutch that drives the entire machine is a Twin Disc Clutch.



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TWIN DISC CLUTCHES

ring a clerical error, the cost ledger distribution will equal the amount of money paid out to the workmen as shown on the payroll ledger.

One other feature of this system that deserves attention is the amount of clerical labor saved in the cost department in extending the total time worked with the rate of pay to find the total cost. As has been shown, the job service cards are closed out at the end of each week by the shop clerk, balanced as to time, and delivered to the payroll department ready for entering the hourly wage rate of the workmen. As soon as the rates have been entered, the total cost or pay is found by multiplying the hours worked with the hourly wage rate. The cards are then separated, the originals being retained in the payroll department where they are filed away by workman's clock number. The duplicate copies, which are sent to the cost department, are sorted by order numbers. The amounts totaled for each order represent the amount expended on that order during the week, this total being charged in on the cost ledger against that order number. Only one extension is necessary for both departments. In most accounting methods, extensions must be made for both the cost department and payroll department. In such a case a fine opportunity is provided for clerical errors which may be very hard to locate later.

Undoubtedly there are many elaborate cost systems which, in spite of the elaborateness, do not give accurate results and might profitably be replaced by some simple system such as this one. If your cost department is not able to obtain a balance between the cost ledger and payroll quickly, it may pay you to look into it with a view to simplifying it. The system outlined here is simple and should be adaptable, with perhaps a few minor changes to meet special conditions, to nearly any kind or type of plant, whether it manufactures for stock or on special order.

Odds and Ends for the Notebook

By R. H. KASPER

A PIECE of rosin, about the size of a walnut, thrown into the ladle will prevent babbitt or lead from exploding when pouring.

When using small, delicate taps, apply the tap wrench to the round part of the tap instead of the square; it will reduce breakage.

As multiplication is usually easier and quicker than long division, multiply the circumference of a circle by .3183 instead of dividing by 3.1416 to find the diameter.

The weight of nine small pieces in ounces equals the weight of a gross of the same pieces in pounds.

The addendum of a gear tooth equals the figure 1 divided by the pitch of the gear.

A reamer may be made to cut slightly larger by first heating it in boiling soda water or warmed oil.

In the absence of a rivet set, the end of a hollow pointed set screw will form a good head.

When replacing one heavy bolt with two lighter bolts, to determine the safe diameter of the smaller bolt for the same load, square the diameter of the larger, divide by two and extract the square root of the result.

A bolt or cap screw may be kept from loosening without the use of a lock washer, by slightly bending the body of the bolt under the head.

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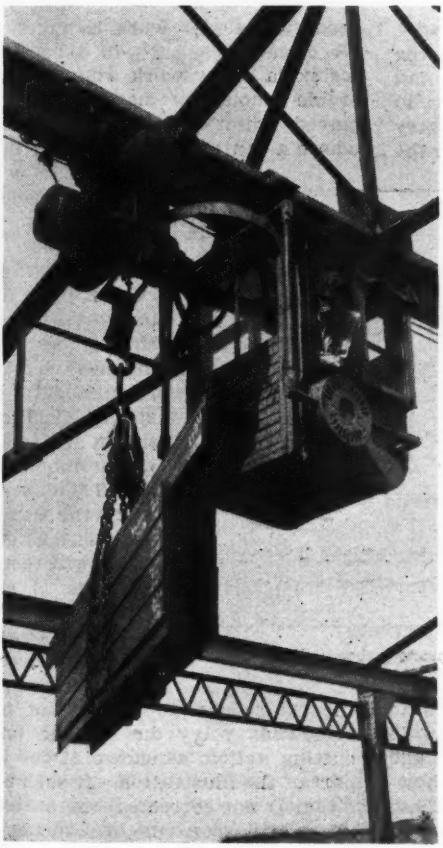

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Milling Machine Arbors

A few pointers on their selection, care, and application

By Frank Curtis,
Research Engineer, Kearney & Trecker Corporation

With all the effort that is constantly being expended on the selection of the milling machine and its cutters and fixtures, in an effort to obtain the maximum efficiency, very little attention seems to be paid to the arbor. The arbor is the back-bone of the milling set-up. A modern machine and efficient fixture and the finest of cutters will fail to produce satisfactorily if the arbor is too small or is improperly supported. For this reason arbors should be selected with care, applied with an adequate knowledge of their importance, and operated accordingly.

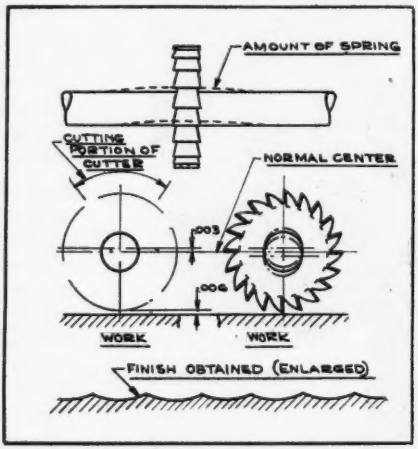

Fig. 1—A sprung arbor will cause poor work and excessive tool wear.

Arbors for production and knee-type milling machines are made in sizes ranging from ⅞ in. to 2½ in. in diameter, namely ⅞, 1, 1¼, 1½, 2 and 2½ inches. For certain set-ups, however, larger sizes are used, but these are considered special in nature. The two smaller sizes, ⅞ and 1 inch, are only to be used where the cut is light, as in light sawing, slotting, oil grooving and the machining of small keyways. The 1¼-in. size is usually used with No. 1 and No. 2 machines; the 1½-in. size is used with No. 2 and No. 3 machines, and the 2-in. arbors are used for heavier work as handled in No. 4 machines. A 2½-in. arbor is used for extra heavy work where a considerable amount of metal is to be removed, whereas a 3-in. arbor is used where a center support cannot be applied, and when the cut is wide and heavy.

An arbor too weak for a given cut is quite likely to spring out of shape—the starting point of trouble. Should an arbor spring 0.003 in., as shown in Fig. 1, the cutter mounted on it will run out 0.006 in. on the diameter. Two serious conditions will then exist; one is excessive wear of the cutter on one side, which reduces its life between grinds, the other is a poor grade of finish, somewhat wavy due to the uneven cutting action, as shown at the lower part of the illustration. If such a condition is not corrected, the cutter expense will soon run into money.

Arbors should be inspected at least once a week. True enough, this recommendation may be considered as just another burden, but on the other hand it will be found to be quite economical in the long run. Regardless of the type of arbor used or the number of machines in use, it will pay to re-

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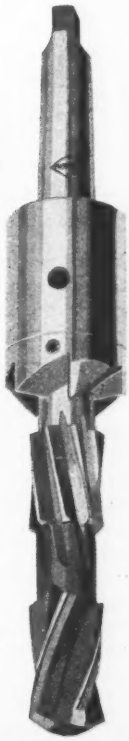

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move all arbors at regular weekly periods, inspect them thoroughly, and then reassemble them in the machine, if they are found to be satisfactory.

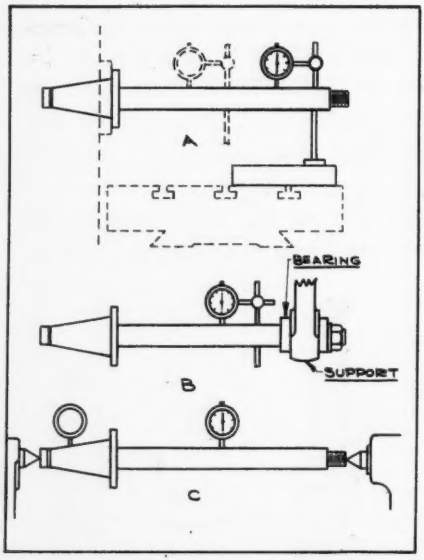

Fig. 2—Methods of inspecting arbors.

Slight accidents often happen—such as running the cutters into the work at a rapid feed rate—and the regular inspection will, of course, detect any harm that such a mishap would have caused.

In Fig. 2 is illustrated the suggested method of inspecting arbors. In the upper part of the illustration at A is shown an arbor being inspected in the machine without an outer support. A test of this kind will show whether or not the arbor is running true in relation to the taper. The spindle of the machine should be operated at a very low speed and the indicator should be moved along the outer end of the arbor.

It is also possible to check the arbor while in the machine as shown at B, using an outboard support as indicated. This test will show any spring that might exist in the arbor, assuming that the taper end is correct. In addition to testing the arbor in the machine, it is advisable to remove the arbor entirely and mount it between centers as shown at C and inspect both the tapered and straight portions. This test will quickly detect any inaccuracy that may exist.

Arbors to be used for accurate work should never run out more than 0.001 in. When the nature of the cut is such that limits of accuracy are not important there will be no real harm in operating an arbor that runs out as much as 0.002 in.

One of the advantages of removing an arbor from the machine is to permit an inspection of the taper end. Although the new taper of the standardized spindles is such that the arbor will not seize or stick in place, there is always the possibility of the arbor being corroded by the lubricant or coolant. Some lubricants contain sulphur which corrodes and "eats"

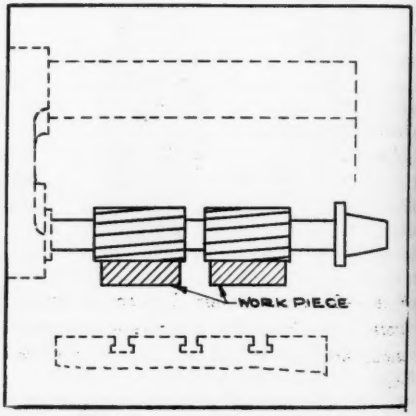

Fig. 3—Milling set-up, using outboard bearing support only.

the surface of the arbor, and a frequent inspection will naturally detect any such action that may be taking place. At the same time it is always well to clean the taper of the arbor,

(Continued on page 35)

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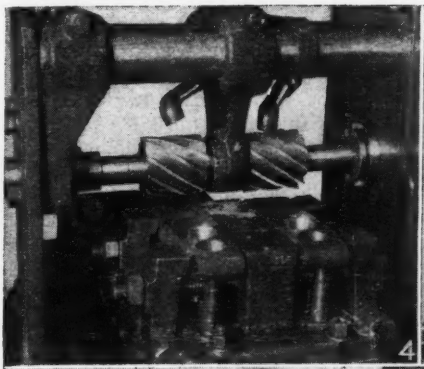
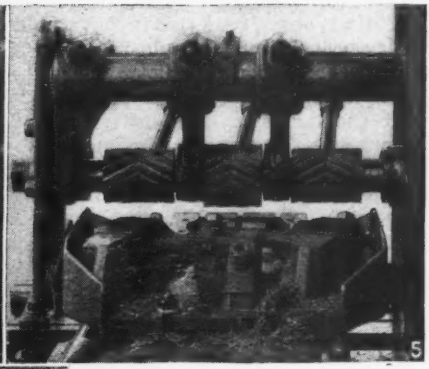




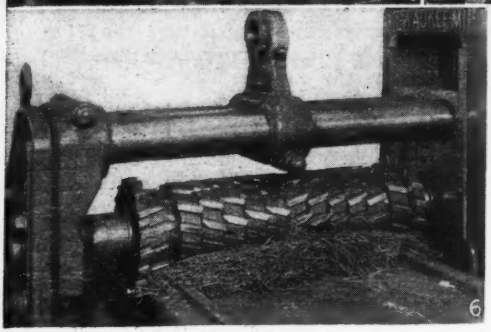


Fig. 4—The central arbor support promotes better work and increased output. Fig. 5—This fixture was designed so that two arbor supports could be used. Fig. 6—When the use of an intermediate arbor support is impossible, an extra large arbor should be used.

Milling Machine Arbors

(*Continued from page* 32)

as well as the taper hole in the spindle, and to wipe the surfaces of both with an oiled cloth when replacing the arbor.

The best of arbors will spring when subjected to excessive strain and it is natural to expect that even the best operator will have a mishap, now and then, that will set up a strain in the arbor. The recommended weekly inspection will, of course, have many advantages. In shops where a large number of milling machines are used, one operator can very easily inspect all the arbors within a few hours. In addition, the same man can be taught to do any repair work that may be necessary as well as to replace damaged arbors with those that have been repaired, or with new ones, if necessary.

Before proceeding with some practical set-ups showing the use of arbor supports, it may be well to mention that the cutter should be properly inspected before being applied. In other words, if a cutter runs out-of-round, due to improper grinding, it will have a tendency to cut only on one side and if it is not inspected carefully, the blame may be unjustly placed on the arbor. Very often it is necessary to design milling fixtures to suit a rigid arbor mounting or to favor a suitable arbor set-up. Quite unfortunately this procedure is often overlooked with the result that the arbor lacks proper support.

Assume the slab milling of two pieces of steel, 3 in. in width, in a horizontal machine equipped with two spiral cutters. If no definite thought were given to the arbor support it is quite likely that the fixture would be made as shown in Fig. 3, using only the outboard bearing support for the

arbor. For some materials and for certain types of cuts this layout would be practical, but it would be far better to spread the spacing of the parts to be milled far enough apart to permit the inclusion of a central arbor support, as shown set up on a Milwaukee milling machine in Fig. 4. Such an arrangement not only strengthens the arbor, but also results in better work and in many cases in a greater output.

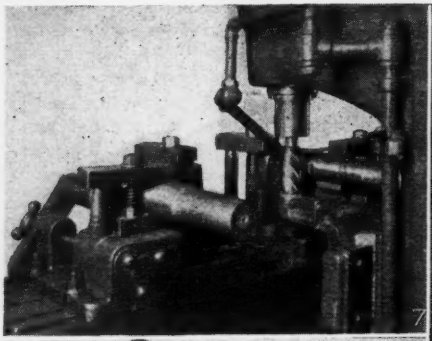
The operation shown in Fig. 5 is an excellent example of a fixture designed in proportion to suit a rigid arbor mounting. Here two center supports are used, which, of course, insures maximum rigidity. If the workpieces had been arranged in any other position than as shown, these supports could not have been used. The parts being milled are forged master connecting rods for a radial airplane engine and are being faced on one side, two at a time. Six spiral cutters are used, being set up as shown in three pairs, each with a left- and right-hand spiral cutter.

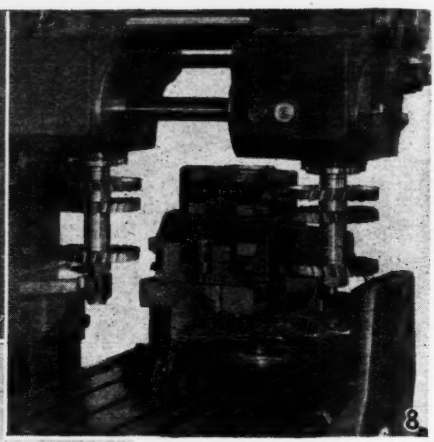
Sometimes a milling cut is encountered in which the use of an intermediate arbor support is prohibited, such as illustrated in Fig. 6. When this occurs, it is advisable to use an extra large size arbor, preferably one of a special design. The gang of cutters shown here is mounted on a 3-in. diameter arbor that is well supported by a large outside bearing. The cut is 25 in. in width, the depth of cut is ⅛ to $\frac{3}{16}$ in., and the feed is 4⅜ in. per minute. Such a cut demands a heavy-duty arbor because one of lighter weight and smaller in size would spring away from the work, resulting in an inaccurate, wavy surface.

Vertical milling machines are often used for face milling various types of surfaces by using an inserted-blade cutter, or solid end mill, attached directly to the spindle nose. Such a set-up does not require an outboard support for the cutter, but then again the same type of machines are used with other cutter combinations that must be fitted with outboard bearings. Such a set-up is shown in Fig. 7, which illustrates a helical cutter that overhangs the spindle for a considerable distance. The support, or outboard bearing—as will be seen—is made in the form of a bracket casting attached to the column of the machine. A bearing of this type assures a rigid mounting for the cutter and as a rule can be arranged without interference to the fixture. In some cases the fixture may have to be made with provision for clearance for the support.

Still another form of outer bearing for a vertical cutter is one that is attached to the machine table, such as is used in connection with a rotary milling fixture. For this type of set-up the machine table is clamped in a stationary position and all movement is provided through the rotary fixture member. Sometimes the outer arbor of cutter bearing can be made as an integral part of the fixture, although a separate bearing bracket support is to be preferred, to permit adjustment to compensate for cutters of different diameters, as well as for cutters that have been reground.

The set-up illustrated in Fig. 8 shows two auxiliary vertical spindles mounted on a No. 3 Milwaukee horizontal milling machine in which two outer bearings for the cutter arbors are used. One is attached to the column of the machine and the other is attached to a bracket connected at the outer end of the knee. The fixture, in this case, is of the indexing type mounted at an angle of 45 deg. and arranged for the milling of three sides at both ends of a copper casting. The spindles are spread far enough apart to avoid any interference be-





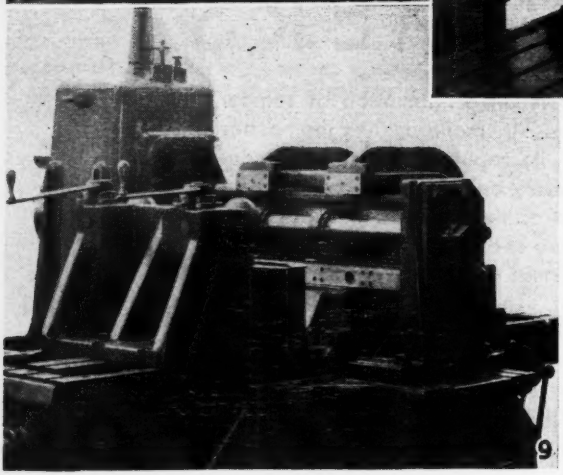
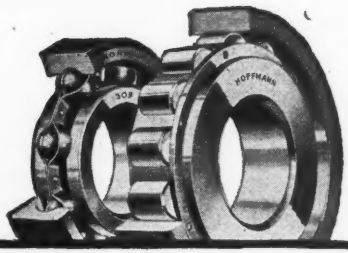


Fig. 7 — Using an outboard bearing to support a helical cutter on a vertical milling machine. Fig. 8—Two vertical cutters with outboard bearings in use on a Milwaukee miller. Fig. 9 — Fixture for straddle milling faces of crankshaft bearings on a cylinder block.

tween the fixture and the cutters or arbors.

With some set-ups it is necessary to go to some expense in order to provide a suitable arbor support; but as a rule the results attained usually compensate for the cost involved. A set-up of this type is illustrated in Fig. 9, which shows a fixture for straddle milling the side faces of crankshaft bearings on a cylinder block, as set up in a Mil-waukee-Mil of the Simplex type. The photograph does not show the cutters in place, although there are a total of ten straddle-milling cutters mounted on the arbor, all of which cut at the same time. A diagrammatic layout showing the position of the cylinder block is illustrated in Fig. 10. The block is clamped against the fixture member A, which is made with a large cored opening at the center through which the arbor and arbor bearing support bracket B is mounted. This set-up is somewhat unusual, although it clearly shows that it is necessary to provide an adequate support for the arbor regardless of expense. The support in this case is such that the arbor receives the usual bearing at the extreme outer end and in addition receives two bearings at the center position, as may be seen clearly in Fig. 9.

Perhaps one of the worst evils to combat is that of using an arbor to suit various old-style cutters in stock, without giving due consideration to



PRECISION
its meaning
and its commercial value . . .

PRECISION, as commonly used, is a term defining extreme refinement of dimension and finish. But as describing an outstanding quality of *NORMA-HOFFMANN Precision Bearings*, the word has a far more comprehensive meaning.

To Norma-Hoffmann engineers and production men, *Precision* means the ultimate in dimensional refinement. Above and beyond this, however, it means bearing design worthy of expression in a finished product of this extreme refinement—selected materials well deserving of special treatments and of highly refined machining processes—standards of production which permit no deviation from absolute uniformity, regardless of quantity.

Precision, as thus described, is the foundation quality upon which the Norma-Hoffmann reputation rests, upon which its business has been built, and upon which it must continue to grow.

But what does all this mean to the buyer and user of *NORMA-HOFFMANN Precision Ball and Roller Bearings?* What, in other words, is the commercial value of *Precision?*

Briefly stated, *Precision* stands for that combination of qualities which manifests itself in higher anti-friction efficiency, longer life, greater speedability, better performance, lower costs for replacements, increased production. These are the distinct and concrete advantages which accrue to the user of *NORMA-HOFFMANN Precision Bearings.*

Obviously, *Precision* is costly to produce and to maintain. But it has been the uniform experience of those who have availed themselves of its advantages, that its price is repaid a hundred fold in the lower after-costs which inevitably follow.

The long, varied experience of Norma-Hoffmann engineers is offered without obligation to machine users and builders facing bearing problems.

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PRECISION BEARINGS

NORMA-HOFFMANN BEARINGS CORPN.- STAMFORD CONN. U.S.A.

JIM K28 JIM K29

the nature of the cut. Some shops have a stock of cutters somewhere from ten to fifteen years of age which have been kept just because they are not worn out and in view of their possible use in one way or another. Some

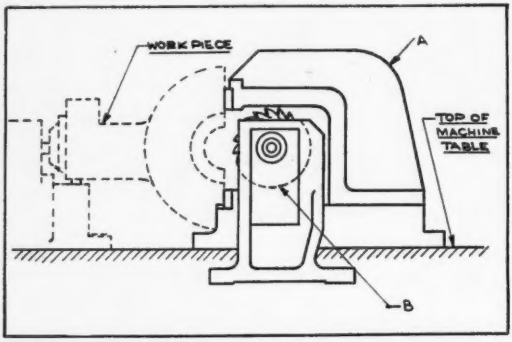

Fig. 10—Drawing showing relative positions of work and cutters, using fixture shown in Fig. 9.

of these cutters have small holes; some have no keyways, yet they are considered practical. The use of such cutters for productive purposes is false economy; in reality, it would be far better to purchase modern cutters to suit a heavier arbor because rigidity is absolutely essential to maximum cutting speeds and feeds.

In the same direction, cutters are often purchased to suit an available arbor with no thought being given to the practicability of that particular arbor in connection with the operation on which it is to be used. Perhaps an operation requires a 3½x3½ in. plain spiral cutter. The order is made out, the purchasing department asks for the size of the hole, the shop foreman says "One inch," and the cutter is received accordingly. A cutter of this size would probably function much better with a 1½ in. or even a 2 in. arbor and the small expenditure required to purchase a new arbor, if one of correct size were not in stock, would soon be repaid by increased output and better finish. Unfortunately, these points are too often overlooked.

Whenever an arbor is found to be sprung or out of shape it should be straightened with the greatest of care. By all means an experienced man should undertake whatever work is required. When an inexperienced operator attempts to straighten a sprung arbor, there is a likelihood that the arbor will be thrown more out of shape than it was originally. Whenever there is doubt as to the practicability of attempting such work, it is far better to return the arbor to the manufacturer with instructions to make any corrections that are required.

The straightening of arbors is usually done in a hydraulic press equipped with a slow feeding action that can be controlled with ease. The arbor is mounted on two supports and

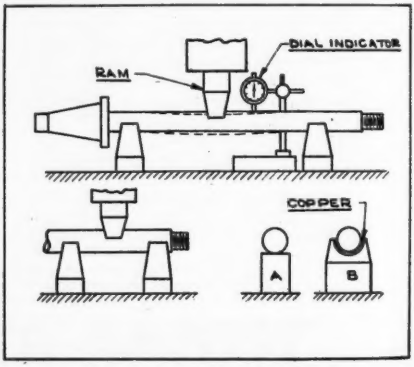

Fig. 11—Drawing illustrating method of straightening arbors.

the ram is lowered so that the arbor is sprung in the opposite direction from the curve. An indicator is usually used in connection with the operation as illustrated in Fig. 11. Prior to

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This lathe is built to close precision limits and will perform *accurately* the same functions as larger lathes. It is furnished in 3-ft., 4-ft., and 5-ft. bed lengths with either full-quick change gear attachment or semi-quick change gear attachment, cone or individual motor drive.

You can't afford to overlook the possibilities of the SHELDON 11" Lathe in your shop—investigate its advantages! Send for an illustrated bulletin!

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11" x 3'	$325.00	$330.00	$405.00	$410.00
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straightening, the arbor is mounted between centers and carefully inspected. The section running out is carefully marked and calculated, so that the straightening operation can be carried on with precision. It is well, in this connection, to use the

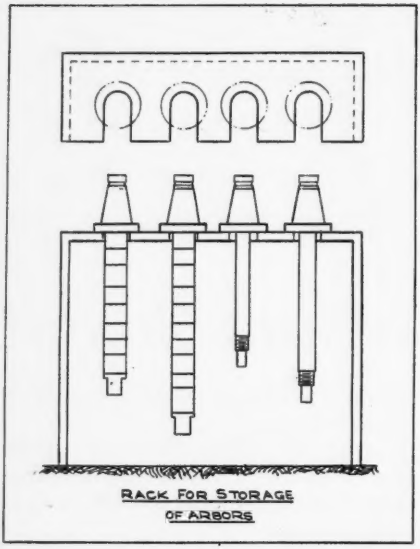

Fig. 12—Design of rack for storing milling machine arbors.

supports for mounting the arbor while straightening. If the support to be used has a straight surface, as shown at A, it is likely to mar or damage the portion of the arbor with which it contacts. For this reason a support such as shown at B, equipped with a copper contacting face corresponding with the diameter of the arbor, should be used.

The careless storage of milling machine arbors often causes them to warp out of shape. If an arbor is kept in a tool crib and is thrown in with a mass of other tools, it cannot escape being damaged sooner or later. In Fig. 12 is illustrated a suggested design of rack for the storage of arbors. The arbors, as will be seen, are supported from the flanged section and hang in a vertical position. Arbors stored in this manner cannot get out of shape.

These rules for the selection, application, operation and care of arbors have been given for the purpose of aiding the users of milling machines to obtain the best results from their equipment. Always remember that the arbor is the backbone of a milling machine set-up and that it should be considered as such at all times. If the suggestions given herewith are carefully carried out, better results can be expected in the form of higher production and a more uniform type of finish. Summing up this data, the arbors should be heavy enough for the operation in hand, the support of the arbor should be rigid, and the arbors should be inspected once a week.

Hobart Manual On "Electric Arc Welding"

The Hobart Brothers Company, Troy, Ohio, has published a manual on the subject of Electric Arc Welding, especially written for the manufacturer who is interested in the possibilities of arc welding as a manufacturing process. A special effort has been made to avoid highly technical and theoretical discussion and to confine the text to a brief, logical, and non-technical arrangement of practical information and suggestions that have been derived from a vast amount of practical experience.

The book contains 80 pages and includes nine chapters on the following subjects: The Welding Arc; Welding Equipment; Types of Joints and Welds; Weldability of Metals; Choice of Electrodes; Using the Metallic Arc; Using the Carbon Arc; Operating Instructions for Hobart "Constant Arc" Welders; Speed and Cost of Arc Welding. A supplementary section is also included in which are shown examples of arc welding, types of Hobart arc welders, and an alphabetical index.

A copy of the book will be sent without charge to any machine shop executive who will state, on his firm letterhead, what kind or type of work he plans on welding.

Notes On the Installation of a Piece-Work System In the Average-Size Plant

By GEORGE HENRY FISHER

THE events of the past year have brought most plant owners to a realization of the fact that, if they are to continue in business, ways and means must be found to reduce manufacturing costs and make their working capital cover more territory than it has been covering in the past. This is true not only of the large operators, but of the smaller ones as well. The bulk of the money that is paid out goes for equipment, material, and labor, but in times like these the purchase of additional equipment is usually set aside until there are enough orders in sight to pay for the two last-named items.

In many cases, the effort to find a method of reducing costs brings the manufacturer face to face with the need for manufacturing costs that will not fluctuate. Material costs do not vary greatly as between purchasers, whereas labor costs may vary as much as 100 per cent, depending upon the efficiency of the equipment, character of supervision, and method of wage-payment. Thus, by the simple process of elimination, the manufacturer finds that the greatest possibilities for economy lie in labor costs.

Most present-day economists agree that our national prosperity is dependent, in a large measure, upon the high purchasing power which is a direct result of adequate wages. Therefore, the ideal condition would be one which would allow the continuance of a high wage scale, while at the same time making possible a reduced cost per piece. Such a condition is only possible where the worker is paid according to the amount of production turned out instead of being paid for the amount of time spent at the plant.

Whether the wage-payment plan is based on piece-work, bonus, or premium, is a matter, first, of the character of the work, and, second, of the preference of the management. All three plans have proved successful under various shop conditions, but piece-work has been chosen as the subject of the present discussion because it is comparatively easy to install, is readily comprehended by the man in the shop, is simple for the payroll department to calculate, and provides a basis for figuring standard costs. In fact, it is the *only* plan known to the writer whereby a standard, non-fluctuating cost can be arrived at, and involves the least amount of slide-rule calculations, algebraic equations, and all-round tomfoolery. Except where standardization of operations is virtually impossible, piece-work will be found to dovetail nicely with the average machine shop layout.

Regardless of the manner of payment employed, the amount of remuneration must be based on fact as to the amount of time required to perform each of the production operations, using efficient equipment and an efficient operator. This fact can only

be determined by making an analytical study of the operation and each of the elements which may have a bearing on the time required to perform it. Such a study can be made by anyone who has the necessary qualifications, but these qualifications are not of the common, or garden variety.

The person who has the task of making the time and motion studies, whether he be the shop foreman in a small plant or a specially-trained production engineer in a large plant, must have a clear understanding of the operations and the possibilities of the equipment. This does not necessarily mean that he must have worked at each and every job that he is called upon to observe; there are many tasks of which the details can be grasped after a moment's study, but insofar as most machine shop equipment is concerned, the only man capable of making an intelligent decision as to the amount of time required to perform an operation is one who "knows his machines" by personal experience and who, by the same token, knows just how much a machine, tool, cutter, or grinding wheel will stand. To this knowledge must be added an agreeable personality, an unusual amount of diplomacy, and at least average intelligence.

The time study man should also have an analytical mind, and with him cost reduction should be a mental habit rather than a dogmatic collection of formulas and policies. He should be able to impress the man at the machine with the fact that they are both cogs in the same industrial machine and convince him, without argument, that a time study man's job is not necessarily to make the operator work faster, but rather to show him how to work more efficiently and thus earn more money both for the firm and for himself.

The human factor is, however, only one element in the waste elimination program. The task of analyzing a job includes a study of each phase of manufacturing procedure, co-ordinating men, materials, and machines to obtain the highest possible efficiency and, finally, recording the results of the analysis, including an accurate record of the time required to perform each detail of the operation. With such a record, the piece-rate can readily be calculated from the operator's hourly rate, adding a certain percentage for the incentive. The first point to be considered, then, is the operation itself. We will think of it as comprising the three elements named above—material, men and machines—but to begin with we will tackle the operation as a single unit.

Operation.

As the time study man watches the operation, he should consider the following points:

1. Is this operation absolutely necessary in the manufacture of the part? Has it been made necessary because of the inefficiency of some previous operation? (This point will bring home to the reader the necessity of beginning the study with the *first* operation on the piece.)

2. Could the operation be performed more efficiently in some other manner; that is, by a different process altogether? This question sometimes involves the design of the part, and co-operation from the designing engineer might result in design changes which would permit of simplifying the operation.

Material.

1. Is the material up to specifications regarding quality and dimensions, so that no difficulty will be encountered from this source?

2. Could manufacturing efficiency be increased by changing to another

material, without affecting the finished product?

3. Would a cheaper material do just as well, from a manufacturing standpoint?

4. Can an adequate supply of material be maintained at this machine, so that the worker will not be delayed on this account?

5. Is the material within easy reach of the operator, so that he does not have to waste time and energy in bringing the parts to the machine? Conveyors, trucks, benches, or tables should be provided with a view to eliminating all possible exertion on the part of the operator. Wherever mechanical handling can be introduced to save labor, it should be provided.

6. Are facilities provided for the quick disposal of the finished part? All extra movements should be eliminated at this point.

Operator.

The operator should be selected with proper regard for the physical strength, stature, sex, and intelligence necessary for efficiently performing the operation.

Equipment.

Investigation should be made to ascertain whether the machine and tools are well adapted to the work, and whether the machine is operating with the most efficient speeds and feeds. If the machine is not in good order, it should be overhauled and brought up to standard. The tools should be sharp and in good condition, and duplicate sets should be provided, if necessary, so that the operator will not have to wait for tools to be ground.

The best speeds and feeds for the job are determined by actual trial. When the happiest combination has been found—considering tool-wear and quality of work—the speed and feed are recorded on the time study form. If the speed or feed is indicated on the machine by the position of a lever, that position should be recorded on the form either by a sketch or number or letter, so that the same feed and speed can be obtained when next the job is to be run.

When everything possible has been done to obtain the best results, specifications for the entire procedure should be written so that every factor will be covered and every variable element will be standardized. Such specifications will not only insure that the operation can be duplicated exactly, but will provide against the possibility of future argument.

With all details apparently attended to, the operation is ready for timing. The operator is instructed not to hurry the job simply because he is being timed, but rather to proceed at a normal rate of speed, omitting all unnecessary movements. The observer takes up a position at one side where he can clearly see every move without getting in the way, and gets his stop-watch and time study blank ready for use. When the operator is sufficiently familiar with the operation so that the operation cycles follow each other in rhythmic procession, the time study man starts the watch, without taking his eyes off the movements of the operator. When the cycle is completed, he stops the watch and notes the reading. If the operation is very short, he allows the watch to record several cycles before stopping it. After obtaining a fair idea of the length of time required for the task, he lists the various movements included in the operation and then proceeds to list the time required for each, repeating the record until he is satisfied that he has all the figures necessary.

The time study man must be able to judge for himself as to the con-

(Continued on page 110)

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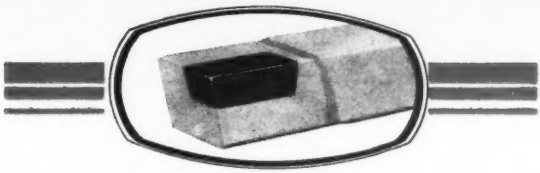

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The Arc Welder's Accessories

In this article the author discusses many details that, while generally accorded scant attention, may account for important wastes or savings.

By JAS. M. VOSSLER
Welding Foreman, Southern Pacific Railway

THE quality of the accessories furnished the arc welder is of more importance than it is usually accredited with. Like any other mechanic, he must be supplied with good tools and equipment if he is to do first class work.

First of all his eyes must be well protected. Where the helmet type of hood can be used, it is by far the best form of eye protection. There are some places where there is not enough room to use a helmet, particularly the type that can be raised when the welder wishes to see his work or change his electrode. In such a case it is necessary to use the type of shield that is held in the hand. In either case, care must be exercised to see that the welder's entire head and neck are protected from the injurious light rays of the arc, and thereby prevent painful skin burns. Care must also be exercised to see that the hood used fits the face sufficiently snug to prevent reflected light from entering the hood from the rear and being thrown into the eyes by the mirror effect of the rear of the lens. Should this happen, painful eye burns will result.

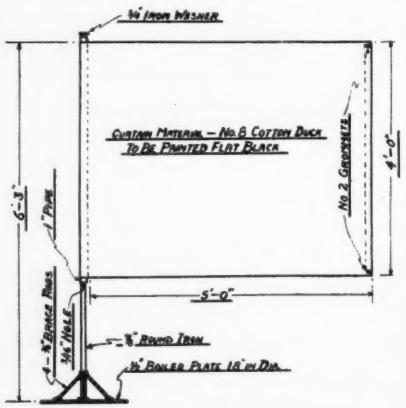
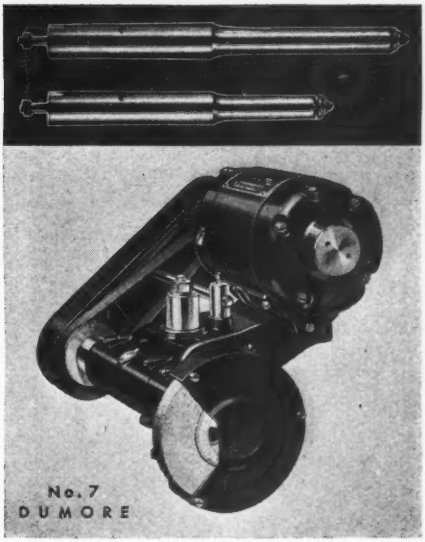


Fig. 1—Design for Welder's Screen

One point which is often overlooked is that of ventilation. Ventilation is not an important factor where the hand shield is used, but if the welder is at his work continuously, it is far better to supply him with the type of helmet that has a visor that can be raised when electrodes are changed, as each time the visor is raised, the air under the helmet is completely changed.

The lens is by far the most important factor of the hood. The two light rays given off by the arc that are injurious to the eye are the ultra-violet ray, and the infra-red ray. While the former is easily eliminated, considerable difficulty is met in keeping

.. For Precision and Production on Deep Internal Grinding Jobs



WITH the development of the new extra-length quills shown here, the Dumore Company now offers grinding units to meet deep-grinding precision demands.

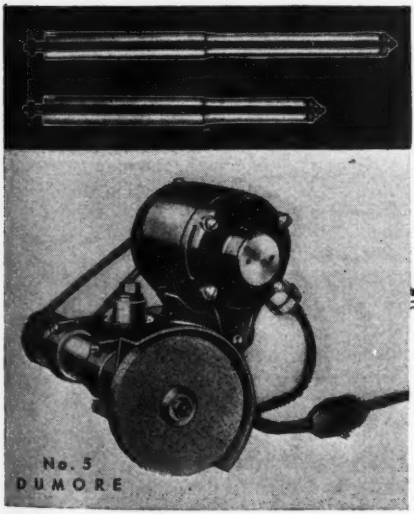
The large No. 7 Dumore Grinder, shown at the right, uses the X-12 and X-8 quills. The specifications are as follows:

X-12 — Diameter of quill housing (maximum) 2" Reach — Will grind 2¼" opening to full depth of 12".

Equipment includes 1 set of wheel collars, 2 wheels, 2½ x ⅜ x ⅜" and 2½ x 1 x ⅜ x ⅜" (cup wheel).

X-8 — Diameter of quill housing (maximum) 2" Reach — Will grind 2¼" opening to a full depth of 8".

Equipment includes 1 set of wheel collars, 2 wheels, 2½ x ⅜ x ⅜" and 2½ x 1 x ⅜ x ⅜" (cup wheel).



The No. 5 Dumore Grinder, shown at the left, uses the B-12 and B-8 quills. The specifications are as follows:

B-12 — Diameter of quill housing (maximum) 1¾" Reach — Will grind 2" opening to a full depth of 12".

Equipment includes wheel collars, two wheels, 2½ x ⅜ x ⅜" and 2 x 1 x ⅜ x ⅜" (cup wheel).

B-8 — Diameter of quill housing (maximum) 1¾" Reach — Will grind 2" opening to a full depth of 8"

Equipment includes wheel collars, two wheels, 2½ x ⅜ x ⅜" and 2 x 1 x ⅜ x ⅜" (cup wheel).

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the latter from the eyes, and a special scientifically prepared lens must be used to screen it out. Just a few years ago we were contented with lens that admitted from 15 to 20 per cent of the infra-red rays, but now a scientifically-

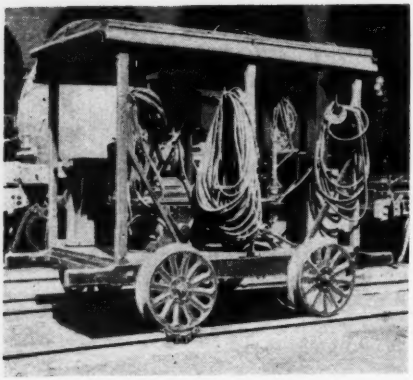

Fig. 2—Welding Equipment Mounted on a Push Car for Round House Use

prepared lens has been placed on the market that is claimed by its makers to admit less than 1 per cent of the infra-red rays. Care should be exercised to furnish the best lens obtainable. All responsible manufacturers of welding lens have had their products tested and approved by the United States Bureau of Standards, and can furnish the report of that bureau. Lens with ground surface only should be used.

It has been the experience of the writer that different welders will ask for different shades of lens for the same class of work. This is to be expected, and should be furnished when asked for. The welder's eyes should be watched, and at any indication of redness, an investigation should be made to see if he is careless in using his hood, or if he has the proper shade of lens. On an average, welders working with currents below 140 amps. will require a shade No. 10 lens, from 140 to 200 amps., a No. 12, and above 200 amps., No. 14.

The proper welding lens is expensive, but if properly cared for and protected, should last indefinitely. Hoods should be furnished that will permit the placing of a clear cover glass both in front and in the rear of the welding lens to protect it from being pitted by flying sparks. The cover glass can be cut from single strength picture glass. Care must be exercised to see that the glass is free of flaws and waves, as these are injurious to the eyes. It is still better to furnish the ground surface glass supplied by the lens manufacturers.

While protection of the eyes of the welder should be given first consideration, the protection of the eyes of his fellow workman is of equal importance, and must not be neglected. The writer has frequently heard the statement that the rays of the arc will not injure the eye at distances greater than twenty feet, but his personal ex-

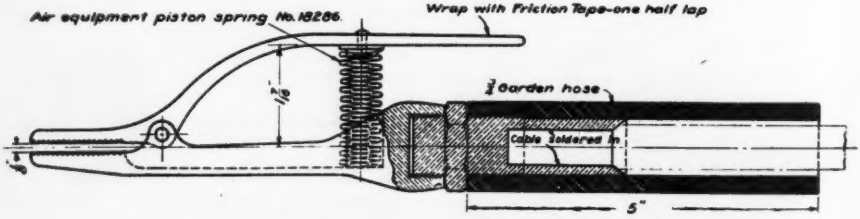

Fig. 3—Design of Electrode Holder Which Was Developed In the Southern Pacific Shops

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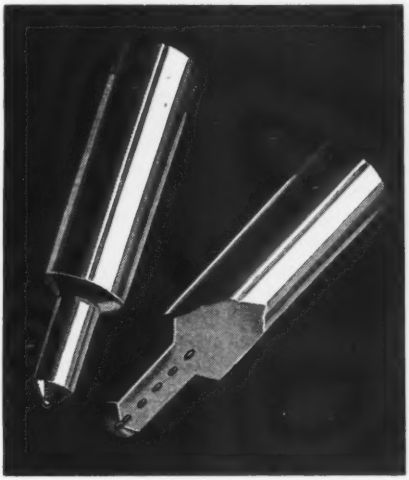

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Economical, because a KOEBEL Multi-Set diamond dresser costs less than the one-stone type; because the KOEBEL Method (Patents Pending) of surrounding the diamonds with a newly developed metal prevents loss; and because it eliminates resetting charges.

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perience has taught him that this is an error. The distance at which the workman may look at the arc without injury depends largely upon the condition of his eyes and the length of time that he looks at the arc. Again, if a workman is within a few feet of an arc welder, the reflection of the injurious rays from surrounding objects will injure his eyes even though he does not look directly at the arc. For these reasons great care should be exercised to screen the arc from the eyes of other workmen whose duties may bring them close to the welder. The folding type screen is well known, and needs no description here. It is a very excellent type of screen, but there are places where it is difficult to use it. It is hard to properly screen a welder working on the frames of a locomotive with such a screen.

In Fig. 1 will be seen a drawing of a very durable welder's screen, which is made in the form of a flag. The base is a piece of scrap boiler plate from three-eighths inch to three-fourths inch in thickness, depending on the material available. The staff is a piece of seven-eighths-inch round iron welded in the center of the base plate, and braced as shown. The curtain is made of canvas, 4 feet high and 5 feet long. One end is sewed around a piece of scrap one-inch pipe or scrap locomotive super-heater unit tubing, 4 ft. 1 in. long. On each end of this pipe, or tube, a loop of $\frac{3}{16}$-in. welding wire is welded. To these loops the curtain is attached, to prevent it from slipping off the pipe or tube. This pipe is then placed on the staff, and an iron washer is welded to the top of the staff to keep it on. When the welder's work is near the floor, the pipe is permitted to rest on the staff brace rods, but when his work is higher up, the pipe is raised to the top of the staff and a short piece of welding rod is placed in the hole in the staff to support the curtain in the raised position. In the upper corner of the curtain an eyelet is placed, as shown, and a piece of $\frac{3}{16}$-in. welding rod is bent in the form of a hook and attached to the curtain through the eyelet. The far edge of the curtain is then supported by attaching the hook to the wall or other convenient location. Where desired, one curtain can be attached to the staff of another until a complete welding booth is formed. When not in use, the screen curtain can be furled about the staff and set aside. The curtain should be painted a flat black, so as to prevent any possible reflection of the injurious light into the welder's eyes from the rear. This type of screen will be found to be very convenient, durable and economical. The ease with which it can be moved about is another very attractive feature.

A wire brush is an indispensable part of the arc welder's kit. There are various forms of brushes on the market, and the type best adapted to the average welding job should be supplied. A very popular type has five rows of steel wire bristles, about an inch long. The bristle portion of the brush is about five inches long and the wooden back of the brush is extended at one end to form a handle. It is generally found that the bristles at the end of the brush are used most frequently and, therefore, wear off more rapidly. When these end bristles wear off too short for use, about an inch of the brush can be cut off, thus leaving longer bristles available for use. Most welders prefer the brushes that are thus shortened.

Although most of the cleaning of a weld can be done with a brush, yet the scale cannot be entirely removed with it. For this purpose a sandblast, where it can be used, is very effective. There are, however, many places where this method is not permissible. The sandblast cannot be used in the open, where the flying sand will be

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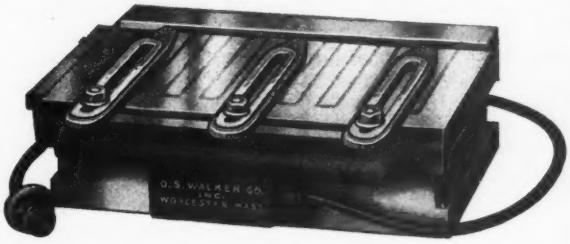

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liable to injure other workmen, nor can it be used where it will be blown into machinery. In most cases it will be found more satisfactory to remove the scale with a chisel applied by a small scaling air hammer. Thor type "MM" air hammer has been found very effective for this work in that it is small and light enough to be used

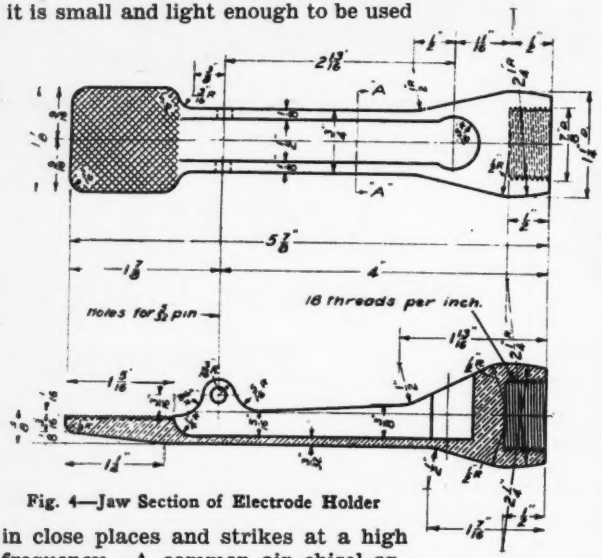


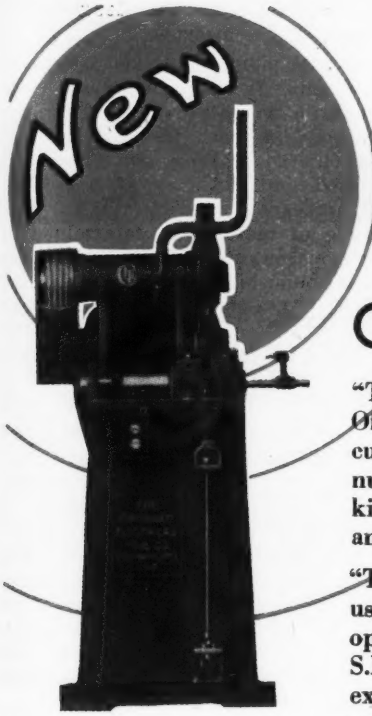
Fig. 4—Jaw Section of Electrode Holder

in close places and strikes at a high frequency. A common air chisel applied lightly is sufficient to remove the scale and is far better than a roughing tool. The latter chops the surface up too much, and is inclined to beat the scale into the surface rather than remove it.

The truck of the electric welding machine, when it is to be used where the floors are smooth, needs little comment, but most welding machines must be moved over rough flooring. This is especially true where the machine is used around a railroad shop, where it must often be moved over tracks. In such a case, the wheels should be not less than 20 in. diameter, in order to prevent excess jar in moving and to facilitate handling. Where the machine is to be used in a railway round house, it is very convenient to mount the welding machine on a covered push car. The push car is transferred from track to track over the turntable and pushed up behind the engine upon which the welding is to be done. Such an arrangement is shown in Fig. 2. The sides and ends of the car are provided with curtains to protect the machine from rain.

Naturally, the most important tool of the arc welder is the electrode or welding wire holder. Over a period of several years the author spent considerable time in attempting to find the most suitable electrode holder for the welders. Several were found that were thought to be generally satisfactory, but in each case it was soon found that the holder had some objectionable feature. One of the greatest difficulties was to find a thumb release holder that was durable and in which the spring could easily and cheaply be replaced. This latter point is very important, since one arc accidentally drawn on the spring will destroy its usefulness. It was finally decided to collect about six or seven of the best holders available and, after studying their relative merits and demerits, design a satisfactory electrode holder that would embody as many of the good points of the holders at hand as possible and attempt to

Fig. 5—Section of Electrode Holder



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eliminate as many objectional features as possible.

The result was the electrode holder shown in Fig. 3, which has proved very satisfactory. It will be noted that the jaw section was so designed that it is easily detached from the handle. There was a double object in this. The first was so that it could be quickly and cheaply replaced without breaking the cable connection, and the second was that it was desired to issue each welder a set of jaws, with the idea that he would take better care of them if he had his own than he would if the holder he used were permanently attached to the cable and were used by the welders that followed him on the other shifts. This arrangement would also enable the supervisor to quickly place the responsibility for damaged holders. This plan has proven successful beyond expectation.

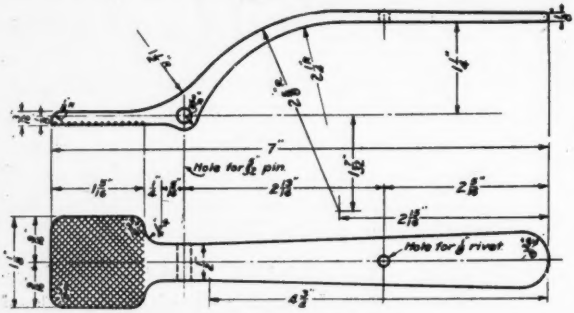


Fig. 6—Lever Portion of Jaw Section

Figure 4 shows the design of the body of the jaw section. This section was made of cast bronze of the following composition:

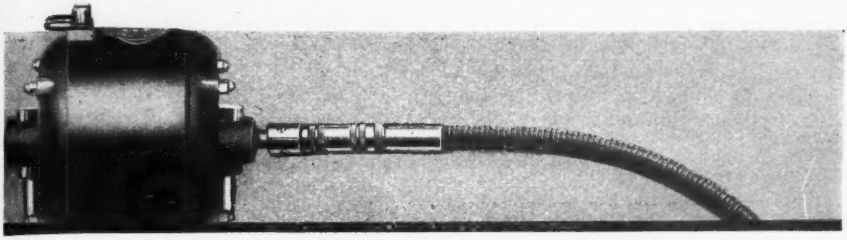
Copper	86% to 90%
Tin	8.5% to 10%
Zinc	1.5% to 3.5%
Lead	.5% to 1%
Impurities	.5% max.

The lead content is held low as much lead would increase the electrical resistance of the bronze.

The first point to be considered was the weight. It was necessary, in order to hold the weight down, to design the main portion with the minimum of metal in the cross-section that could be used and yet carry the current without excess heating. When this volume of metal was determined, it was apparent that if the shape were either round or rectangular, it would not have sufficient strength. Consequently, it was decided to make it "U" shaped, as shown in Fig. 5. The jaws were made broad in order to insure a liberal amount of contact with the electrode or welding rod for electrical conductivity. The jaw contact surfaces are shown knurled, but the knurling is very fine. The finer the knurling, the greater the contact that is made with the welding rod.

In Fig. 6 will be seen the lever portion of the jaw section, which is likewise made of cast bronze of the composition described above. It will be noted that both the jaw body and jaw lever are carefully designed, so that a minimum of machine work necessary will be required.

Again referring to Fig. 3, it will be noted that the jaws are ⅛ in. apart when parallel. The advantage of this design is that, by having the jaws parallel when gripping, the welding rod can be turned to any angle and still be held tight. If the jaws were made parallel when they were touching, the rod would be gripped firmly only when it was held perpendicular to the center line of the holder. Although the average electrode used in most railway work is $\frac{5}{32}$ in. in diam-



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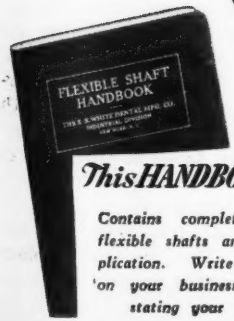

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eter, the jaws are shown parallel at ⅛ in. This is done because the flow of current soon burns the peaks off the knurling, leaving it in proper condition to grip ⅜ in. and ¼ in. rods satisfactorily.

The spring shown in Fig. 3 is an air brake equipment spring and was chosen because it is easy to obtain in all railway shops and roundhouses. The electrode holder was designed for use with this spring. Springs so used in electrode holders are short-lived, due to two facts. First, just one accidental arc drawn on the spring will destroy its usefulness. Second, considerable electric current is ordinarily conducted from the jaw body to the jaw lever by the spring, which causes the spring to heat and lose its temper. It will be noted in Fig. 3 that the spring of this holder is well insulated from the lever. A fibre washer slightly larger in diameter than the spring is placed against the lever, and against this washer is another and thicker fibre washer, of a diameter slightly smaller than the inside diameter of the spring. The two are held to the lever by a copper rivet. The function of the washer first mentioned is to insulate the spring from the jaw lever, the task of the second being to center the spring on the first washer, and insulate it from the rivet. The dimensions of these washers are shown in Fig. 7. They are made from a hard fibre, which does not easily absorb moisture.

Fig. 8 shows the design of the handle body. This piece is made of bronze of the specifications shown above. It is drilled out so that the welding cable can be soldered to it. A number of types of mechanical cable-clamping arrangements were tried, but all were inclined to heat too much. As shown in Fig. 3, the handle is made of ¾-in. water or garden hose. Different kinds of wood were first tried, but they would soon tend to split and break off. Next, air hose was tried, but it was not satisfactory. At last water hose was used, with complete satisfaction. It was found that the rubber hose handle protects the welding cable. Most of the heating of electrode holders is caused by the breaking of strands in the cable just

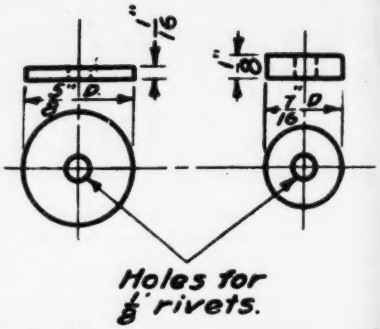

Fig. 7—Insulation Washers

at the edge of the electrode holder handle. The soft, pliable garden hose bends with the cable, and does not tend to break the strands so readily. It also forms a very comfortable handle.

It will be noted in Figs. 3 and 8, that there is ¾ in. of thread on the handle-body under the hose. It was found necessary to roughen this surface to prevent the hose from slipping off, and the threads were found not only very effective, but the cheapest means of accomplishing this purpose. Caution must be exercised to see that the jaws of an electrode holder are kept clean. These jaws soon become burned on the knurled gripping surface, and should be kept clean with a file. If this is not done, the electrode holder will heat, in use, until it reaches a point where it is uncomfortable to hold in the hand.

Choosing of cable sizes is very important. First, the electrode holder

(Continued on page 67)

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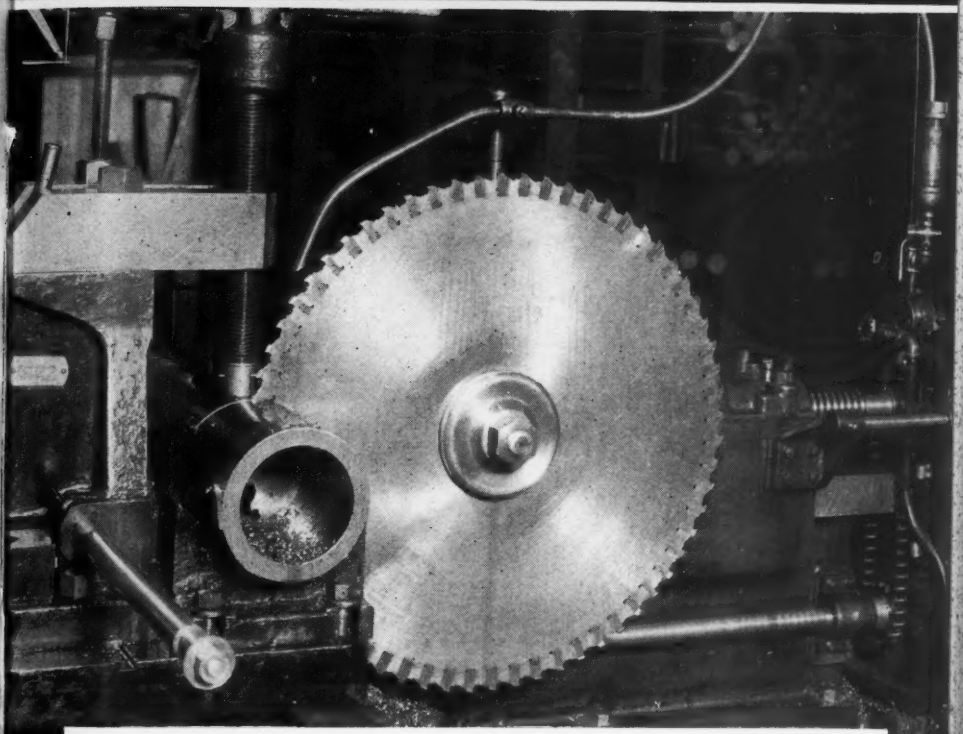

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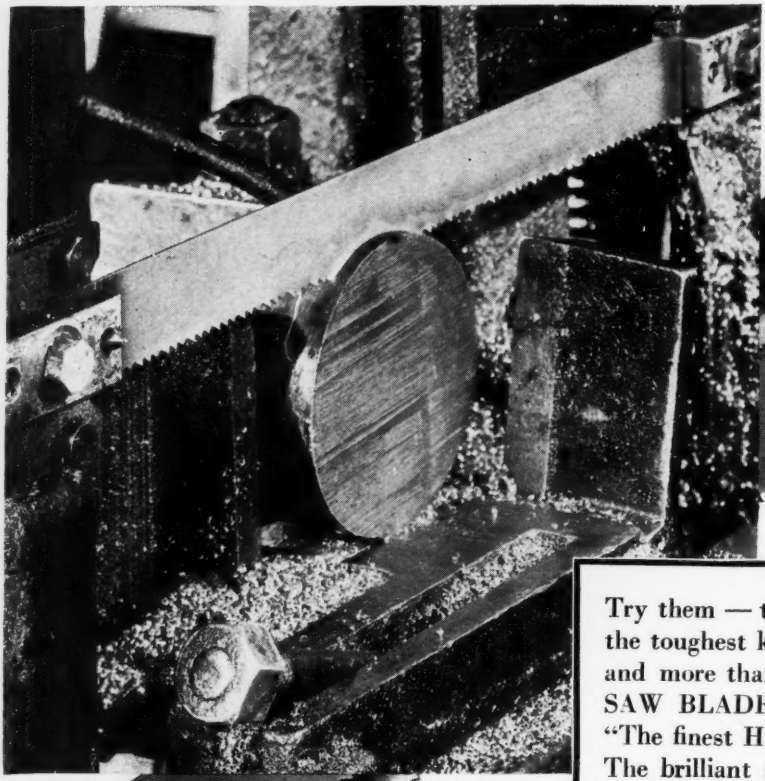

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Arc Welder's Accessories

(Continued from page 62)

should be attached to the main welding cable by a piece of extra fine stranded cable for flexibility. This arrangement will enable the welder to manipulate the holder more easily. Experience has shown that for this purpose a double braided cable of 7/7/59/.005 stranding is best. It is best not to have rubber in the insulation, as it will interfere with the flexibility. The length of this extra flexible cable should be governed by local conditions. Generally five feet will be found sufficient.

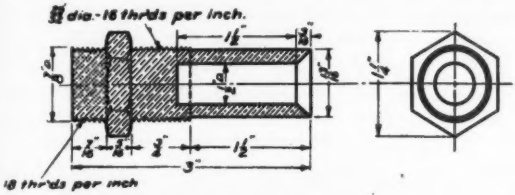

Fig. 8—Design of Electrode Handle Body

The size of the main cables; that is, what are generally known as the welding cable and the ground cable, depends on the length of the cable, and the current flowing through it. Where the cables are not over twenty-five or thirty feet in length, a size No. 1 cable will generally be found to be satisfactory for ordinary work. Where the cables are around fifty feet in length, size No. 0 cable is best, but where it is necessary to use cables up to one hundred feet in length, it will be found more satisfactory to use size No. 2/0 cable. These sizes are for current values ordinarily used in a railway shop.

A solid rubber insulated cable has been found to be more durable where it is to be used over rough flooring, such as is generally found in most shops, and especially if the cable must occasionally be laid through water. The insulation of the ground cable is not as important as the welding cable, as it is of the same polarity as the work. When the insulation starts to break on the welding cable it is an economical move to use it as a ground cable, and renew the welding cable. By doing this it will be found that the strands of the ground cable will begin to break at about the same time as the insluation of the welding cable. Thus a well insulated cable is kept on the welding cable position, and yet by transferring old welding cables to the ground cable position the full life of the cable is secured. As a terminal for the ground cable a "C" clamp of sufficient opening has generally been found to be best.

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Radius Planing Attachment for Shaper

By H. H. HENSON

THE radius on any kind of locomotive valve gear with which links and link blocks are used can be machined on a shaper by the use of the attachment shown in the illustration. It can also be used for other work on which curved surfaces are required to be machined.

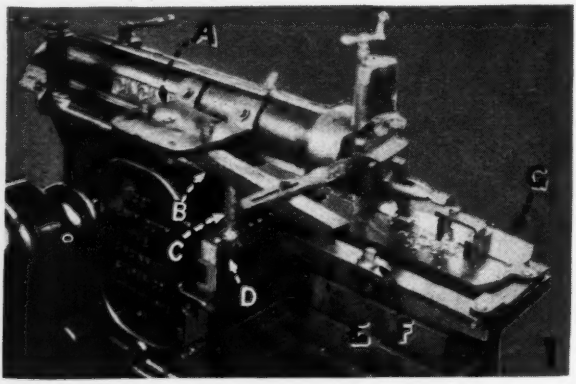


Fig. 1—Shaper with radius planing attachment.

The principal parts of the attachment are the bracket member **A**, the adjustable radius guide **B**, radius guide stud **C**, adjustable transmission bar **D**, fulcrum lever **E**, fulcrum lever stud **F**, oscillating table **G**, bed plate **H** (Fig. 2), and radius adjusting guide brace shown projecting from the front end of the ram. The radius guide **B** is locked securely to the bracket **A** and also to the radius guide brace with the upper end of the radius guide stud **C** riding in the slot in the under side of the radius guide **B**. As the ram of the shaper moves forward, the stud **C** is forced sidewise, carrying the transmission bar **D** which in turn swings the fulcrum lever **E** and thus swings the table **G**. As the ram moves backward, the movement is reversed. In order to make possible the machining of radii of various dimensions, six 1-in. U. S. Std. Thd. holes are provided in the transmission bar **D** for the stud **C**.

When setting up the attachment, the radius **B** is set at an angle which will provide the correct radius and the stud **C** is screwed into the nearest hole. Obviously, the greater the angle at which the guide is set, the sharper the radius. The bracket **A** and radius guide brace may be graduated, if desired, to save time on subsequent set-ups. The piece shown in process in the illustrations is a link block for a Walschaert valve gear. The block is laid off on the upper face and clamped in position, then a pointer is clamped in the toolholder and the ram is moved forward and back, the rear end of the radius guide being adjusted meanwhile until the correct radius is obtained. The machining can progress as fast when using the

attachment as when no attachment is in use, and heavy cuts can be taken. In the shop where this tool was de-

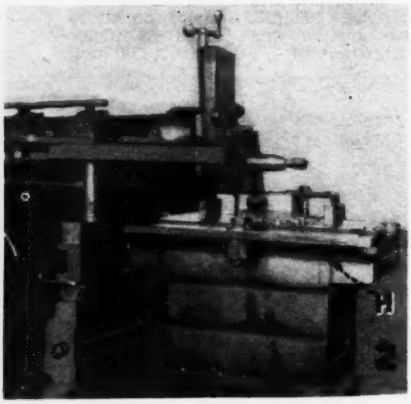


Fig. 2—Side view showing bed plate.

signed it is considered a good production tool on link blocks.

The bracket **A** is made of ¾-in. boiler plate and is bolted to the ram, as shown. The radius guide **B** is a steel forging, 8¼ in. wide by 42¾ in. long, containing a 1½ in. square groove in the under side. The guide stud **C** carries a bronze guide block which slides in the groove as the radius guide passes over it. The transmission bar **D** is of 2½ in. square stock, 24 in. long, and the fulcrum lever **E** is 1 x 3⅛ x 34½ in. The oscillating table is 2⅜ in. thick with a working surface 14⅜ x 28¼ in. The "ears" for the stud holes at the ends are each 2⅝ in. long, and the holes are 1 in. diameter. The table swings at the center on a stud which is screwed into the bed plate.

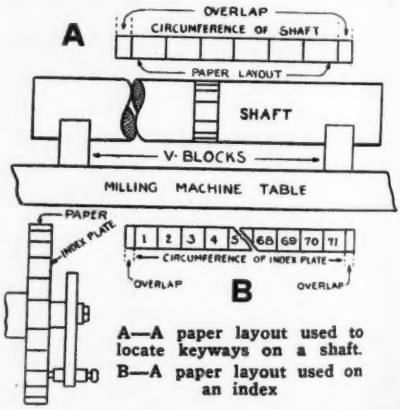
Working To Paper Layouts

By CHARLES KUGLER

IN every job shop a job comes along now and then for which a paper layout can be made that will be as efficient as it is cheap. For many jobs a paper layout is accurate enough, and often a paper layout or templet can be used to simplify an operation that would otherwise be long drawn out and expensive.

At **A** in the drawing is shown a large shaft in which six keyways were to be cut near the center. The shaft was 13 in. in diameter and 16 feet long. By multiplying the diameter by 3.1416, the circumference was found—40.840 in.—and a strip of paper was cut to that length plus enough for lapping at the ends, then this dimension was divided into six equal parts, each 6.8 in. long. The paper was then wrapped around the shaft and the ends pasted as shown. The keyways were cut in the usual manner, a surface gage being used to locate the divisions as indicated on the paper layout.

The sketch **B** shows how the same method was used in connection with an index head to obtain the necessary divisions in cutting a ratchet wheel. The wheel was to have 71 teeth,



A—A paper layout used to locate keyways on a shaft.
B—A paper layout used on an index

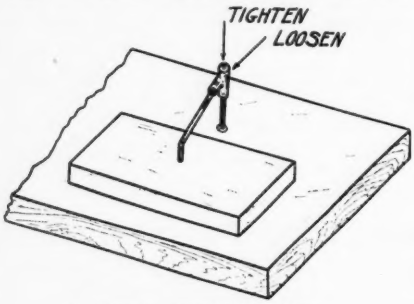
which could not be cut with the index head plates on hand. Accordingly, a strip of paper equal in length to the circumference of the index head was obtained, divided into 71

equal parts, and pasted on the index head as shown. Each line in turn was located by the use of a surface gage and an accurate job was obtained without difficulty. As only 1/40 of an error in the index plate is transmitted to the work spindle, an error of 0.040 in. in the layout would equal only 0.001 on the work if the work were of the same diameter as the index plate. If larger, the error would be less, and if smaller, it would be greater.

A Simple Bench Hold-Down

By R. H. KASPER

THE sketch shows the construction of a simple bench hold-down, which will be found useful for holding flat work on the bench for scraping or laying-out. This is similar to a clamp at one time in common use among woodworkers. The upright rod is an easy sliding fit in a bushing which is inserted in the top of the bench. The clamping arm stands at about sixty degrees with the upright arm. Both parts are made of ⅜ inch drill rod. To tighten, the connecting fitting is struck downward, and



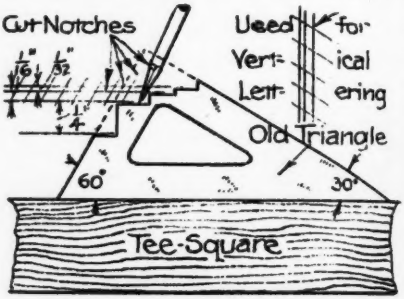
A Simple Bench Hold-Down.

to loosen, it is struck forward, as indicated by the arrows. The angularity of the holding arm causes the upright arm to be sprung backward when struck, causing it to bind in the bushing. The contact end of the clamping arm is rounded to prevent marring the work.

Lettering Guide-Line Templet

By MORRIS A. HALL

UNLESS guide lines for lettering are accurately spaced, a drawing may easily carry a dozen or more different sizes of letters and figures.



A Handy Lettering Guide-Line Templet.

This variation can be prevented and all guide lines can be evenly spaced by the use of a templet such as that shown in the illustration.

The templet is made from an old 30-60-degree triangle, in the corner of which four or more notches have been cut, as shown. The steps of 1/16 in. and 1/16 in. together produce a space 3/32 in. high, the 1/16 in. and ¼ in. steps together provide a space for letters 11/32 in. high, while the ¼ in. step can be used alone for all capitals, as in a title. Other combinations can be worked out to produce an infinite number of sizes to suit the work or personal preferences.

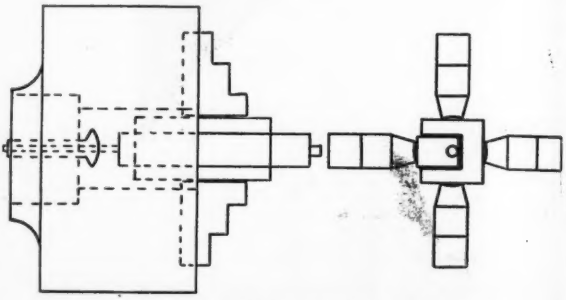
When the triangle is used in a horizontal position, as shown, the left-hand edge may be used as a slope line for horizontal letters. In this position, also, the right-hand edge serves as a guide for slope lines for vertical letters, although the triangle has to

be turned to provide the guide lines. As a time-saver and an aid in producing better and neater work, a templet of this kind is well worth the sacrifice of an old triangle and the time necessary to cut the notches.

A Clamping "Kink"

By C. R. DILTHEY

THE drawing illustrates a method used by the writer to simplify the task of chucking a quantity of ½ x ⅝-in. cold rolled steel pieces on which the ends were to be turned. The turned portion was offset from center, as shown.



The work-piece is held by one jaw of the chuck.

A grooved block was made with the groove, which was square, enough larger than the ½-in. dimension of the work to provide a sliding fit and just deep enough to allow a small portion of the work-piece to project. Then the block was chucked so that the end of the piece could be turned at exactly the correct position, three of the chuck-jaws holding the block while the fourth jaw held the work-piece in the block. After obtaining the proper setting, it was only necessary to loosen the one jaw which held the piece in order to change pieces, which not only simplified the matter of chucking, but provided for the accurate location of each piece without the necessity of cutting and trying. The first operation was, of course, to face all the pieces to the same length, after which the regular lathe stops were used in conjunction with the cutting tools to obtain accurate measurements. The cost of making the block was negligible compared to the saving that was made in time.

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Over the Editor's Desk

Buying Equipment "On Time"

ONE of the most disheartening drags on any business consists in a lack of capital with which, by the purchase of more modern equipment, manufacturing costs could be reduced and savings could be made that would more than justify the expenditure. Even in times of normal business activity, it may be a questionable move for the head of a business to pay out, in a lump sum, perhaps 25 to 50 per cent of his available capital for equipment that must, of necessity, take many months to earn back the money invested.

The greatest cause of business failures, as most well-informed business men know, is lack of working capital. However, not only the small manufacturer, but the large one as well, finds himself at one time or another faced with the problem of trying to market his product in competition with other firms whose costs are lower than his are, or of spending his capital for cost-reducing equipment and then having nothing left on which to operate. More than one manufacturer has had the sad experience of refusing a highly desirable order because there was no profit in it, and then seeing it gathered in by a competitor who could —and did—make a profit on it at a lower price because he was better equipped. Of course, every firm expects to keep up with the procession when it starts in business, but Lady Luck is fickle and anything can happen from a fire or a suit for damages to a business depression, aided and abetted by a buyers' strike. An important machine may be rendered obsolete overnight by the development of a new and better piece of equipment, or the machinery may just wear out in a plant where a superficial knowledge of operating expense has made no allowance for depreciation. Whatever the cause, it sometimes happens that money for new equipment is not available just when it is needed most.

The machine tool field has been, until recently, one of the few fields left in which merchandising—insofar as this country is concerned — was handled on a cash basis. Reports indicate that equipment has been sold by American manufacturers, in the past, to both Pan-American countries and to Soviet Russia, with credits running as long as a year. Recently, however, a number of manufacturers of metal-working machinery have adopted the "serial payment" plan as a part of their merchandising policies, and most of those who have not as yet adopted the plan are giving it consideration.

The owner of a manufacturing plant has been able, in the past, to buy a home, an automobile, a radio receiving set, household furnishings — in fact, practically anything he needed —on the deferred payment plan, excepting equipment for his plant. And all in spite of the fact that the plant was the most important of the lot. If the serial form of payment is successful in the merchandising of all other forms of merchandise, it would seem that it should be just as successful in the merchandising of machine tools.

Results In Valu

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Rockford Machine Tool Company

MANUFACTURERS OF
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Dec. 12,1930

Mr. Don G. Gardner,
Modern Machine Shop,
128 Opera Place,
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Dear Mr. Gardner:

It is a pleasure for us to advise that our advertising in your magazine has resulted in many valuable "leads", which in some cases have developed into orders of Great value.

Our space has been increased because of the above given fact.

Yours very truly,

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ROCKFORD MACHINE TOOL COMPANY
V.P. & Gen. Mgr.

New Shop Equipment

Ex-Cell-O Semi-Automatic Steering Gear Case Machine

A semi-automatic machine with which the holes in a steering gear case are drilled, reamed, counterbored, and tapped at one loading, has been developed by the Kreuger Division of the Ex-Cell-O Aircraft & Tool Corporation, 1202 Oakman Blvd., Detroit, Michigan. The machine is equipped with three multiple heads mounted on the vertical column of the machine proper, with two additional multiple heads forming two side units. The units are individually-operated by an automatic drilling and tapping motor-driven unit.

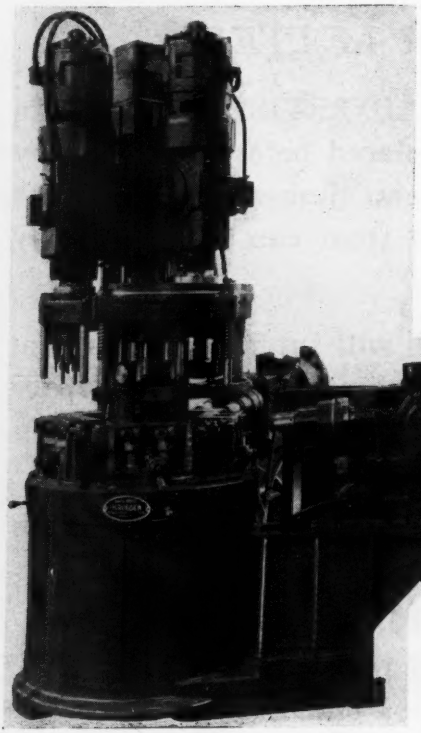


Fig. 1—Ex-Cell-O Semi-Automatic Gear Case Machine.

The fixtures for holding the parts during the various operations are mounted on an automatic rotary table. There are five individual fixtures, each fixture holding two parts. The part is located in the fixture horizontally over a plug that is flattened both top and bottom and is forced back against the end of the plug and up against the large flat face by means of an equalizing clamp operating through a pinion and jig lock. By registering the flat face against the end of the plug, the accuracy of location between the hole in the barrel and the two dowel holes in the large flat face is held with respect to each other within plus or minus 0.001 in. The large dowel hole is $\frac{11}{16}$ in. diameter and the smaller one is $\frac{5}{8}$ in. diameter.

The rotary table is automatic with five operating stations, at the first of which the large recess of the flat face in the part is counterbored and one of the heads mounted in an angular position on a side unit counterbores the long hole in the body of the part. The counterbore is piloted with a roller pilot in the main locating plug. At the second station, five holes are drilled in each part, four holes being located on the top of the flat face while the fifth is located in the bottom of the part. The long bore is also finish counterbored with another roller pilot cutter by a second multiple head mounted on a side unit. At the third station, three holes of these parts are countersunk and the two dowel holes are reamed, these being the five holes that were reamed in the previous operation. At the fourth station, three holes are tapped in each part, which finishes the operation.

The complete machine is electrically synchronized, making it "fool-proof," so that the automatic rotary table cannot

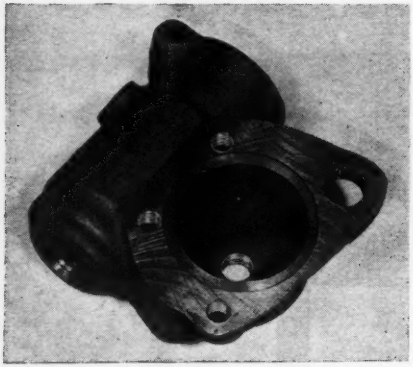


Fig. 2—Steering Gear Case for which machine shown in Fig. 1 was built.

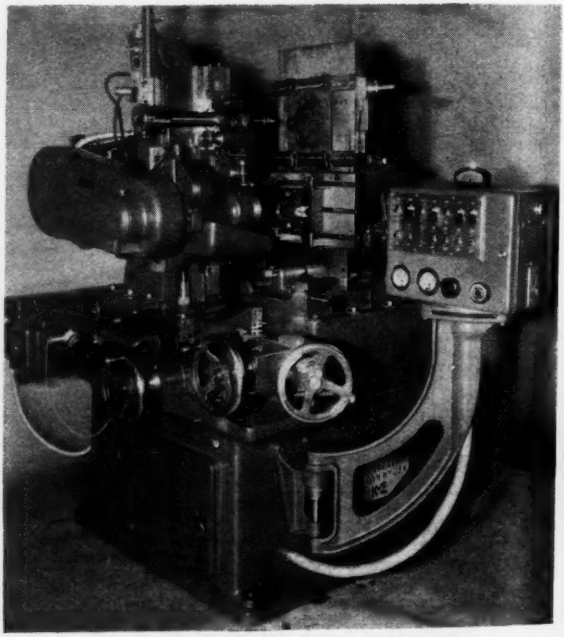
be indexed during any operation nor when any of the units are not in the back position. As soon as all the units are in the back position, the table is automatically indexed and the units automatically start on their respective operations. All units are governed by automatic controls that are centralized in one control panel which was designed by Ex-Cell-O engineers. The machine can be started or stopped from the front or rear, as there are three sets of control buttons conveniently located.

Each vertical multiple head is equipped with hardened and ground guide bars, operating in hardened and ground bushings, which pilot the fixture. Thus perfect alignment is assured at all times. The multiple heads are of standard construction throughout. Gears are of heat-treated alloy steel. Ball-bearings throughout the head insure ease of operation.

Keller Small Automatic Toolroom Machines

The Keller Mechanical Engineering Corporation, 84 Washington St., Brooklyn, N. Y., announces two automatic toolroom machines—Types G-1210 and GG-1210—which are intended for use on a wide variety of tool work up to 12 x 10 inches. The machines are designed for the rapid, accurate, and economical production of trimming, blanking, piercing, extrusion and progressive dies, also molds, cams, punches, and other odd-shaped work that can be milled from templates. The Type GG-1210 machine is equipped with a built-in jig-boring device so that one may machine, locate, drill, and bore to utmost precision in one setting.

In these smaller machines the same principles are employed that are used so successfully on the larger Keller machines. They are built with the same massive rigidity, operate with equal sensitivity, and possess a range of spindle speeds from 225 to 3,500 r.p.m. —which is further increased to 10,000



Keller Type G-1210 Automatic Toolroom Machine.

r.p.m. by the use of the Keller super high speed spindle. The manufacturer claims the machines are rugged enough to stand heavy hogging cuts, and at the same time are sensitive enough to use effectively mills as small as 0.042 in. diameter. As in the larger Keller machines, the cutter spindle is guided by simple electrical control from the tracer, following the contour of a template. Aside from occasional manual manipulation of the tracer control ring to give the machine its directional bias, all contour operation is automatic.

Of interest to makers of blanking dies is the ease and economy with which flanged punches can be cut on these machines. The advantages of the flanged punch are generally recognized, but their use has been restricted in the past due to the great expense of producing them. The machines are fixtured to permit the quick and accurate turning over of template and job, necessary in relieving dies from the back.

The column of each machine slides on a horizontal bed and carries the vertical slide for the up-and-down movement of the cutter head. In addition to automatic control, the vertical and horizontal movements are obtained by hand by means of switches or hand wheels. The transverse movement is in the work table operated by hand wheel. In the Type GG-1210 machine a power transverse feed is provided for jig-boring, also built-in Vernier scales, magnifier and reading lights.

A 1½-h.p. D. C. motor drives the standard cutter spindle by V-belt and four step pulleys, giving four speeds through the open belt and four through back gears which are engaged or disengaged by means of a single lever. An ample stream of coolant is supplied by a motor-driven pump.

Landis Solid Adjustable Die Head

The Landis Machine Co., Inc., Waynesboro, Penna., has placed on the market a solid adjustable die head for application to the various types of special automatic machines with power feed and head reversing mechanism, now used for threading pipe fittings and valves.

This die head is available in the ¾ in., 2 in. and 4 in. sizes. It is compact in design and covers a wide range. The assembly consists of four major parts,

Convincing Proof

. . . that Hardened Metallic Drive Screws make *stronger* as well as cheaper fastenings

The easiest and cheapest way of making permanent fastenings is also the strongest. Merely hammering Hardened Metallic Drive Screws into holes, drilled or formed in iron, brass and aluminum castings, steel or Bakelite, makes better fastenings than those made with machine screws or bolts and nuts. This is proven by comparative laboratory tests conducted by unbiased authorities.

A convincing explanation of the greater holding power of a Hardened Metallic Drive Screw under vibration, the chief cause of fastening failure, is offered by the microscope. Remembering that the security of a fastening under vibration depends upon how tightly the Screw threads are engaged in the metal, look at the unretouched microphotographs here. It is easy to see why the Hardened Metallic Drive Screw holds better.

Note how this unique Screw forms a thread in the metal as it is driven . . . how that action embeds the screw threads so firmly in the metal that screw and metal are practically one. Then observe that between the machine screw threads and the tapped threads (commercial tolerance) there is considerable space . . . space which permits the machine screw to loosen under vibration.

Under stresses of tension and shear, a stronger fastening is obtained with a Hardened Metallic Drive Screw because it possesses greater tensile strength than an ordinary screw, being made of a special steel, scientifically treated.

The booklet offered here shows how users of these Screws effect substantial savings through elimination of slow and costly tapping, fumbling with bolts and nuts and other assembly difficulties. Use coupon to obtain it.

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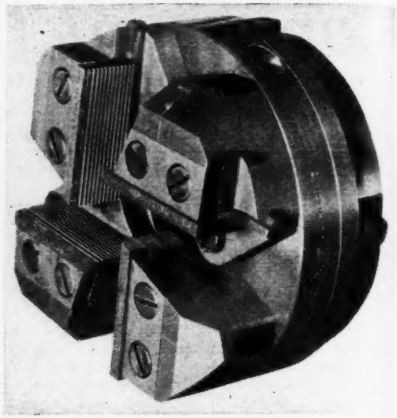
all of which are made of high carbon steel, heat treated and ground. The adjustment for size is effected by the operation of two adjusting screws.



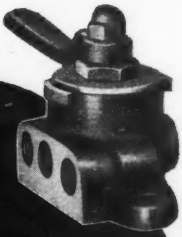
Landis Solid Adjustable Die Head.

These adjusting screws lock the die head and impart a rigidity equal to that of the solid die. This die head employs the Patented Landis Chaser which insures thread accuracy, high production and low tool cost.

Kearney & Trecker "Full-Back Blade" Tungsten Carbide Milling Cutter

Ample strength and rigidity, permitting full use of the high cutting speeds and feeds of cemented tungsten carbide, have been basically embodied in a face milling cutter now being marketed by the Kearney & Trecker Corporation, Milwaukee, Wisconsin. The cutter is known as the "Full-Back Blade" type because each blade is provided with a solid, positive contact along its entire back face, a feature that is highly essential for the correct application of tungsten carbide metals. Two of these cutters are illustrated in Fig. 1, representing the 5- and 8-in. sizes.

Instead of having the blades project beyond the face of the cutter-body, which is the usual practice for other cutting metals, they are set practically flush with this face, chip clearance being attained by cutting suitable slots in the body for each individual blade.



Model "T"

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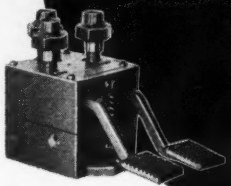
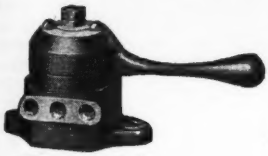
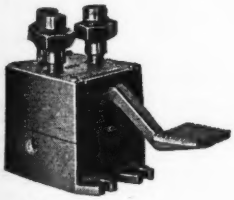


Model "H"



Model "P"



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Designers and manufacturers of Air-operated devices for every work holding requirement as well as many other purposes.

This construction, a sectional view of which is shown at the right of Fig. 2, offers a positive full-length backing for the blades and insures maximum support directly back of the cutting edges where it is most essential, so that the full benefits of tungsten carbide can be gained.

The cutter can be furnished in sizes ranging from 5 to 14 in. diameter, either left or right hand, with blades that are applicable for medium and semi-roughing, or for finishing cuts. Their design is suited for the milling of cast-iron, semi-steel, malleable iron, bronze, copper, and aluminum. The cutter body is made from an extra-heavy steel forging that is heat-treated, hardened, and ground to insure long life. Each blade is made with a tapered face and is held

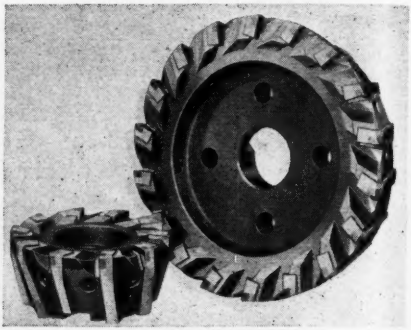

Fig. 1—Kearney & Trecker Full-Back Blade Milling Cutter designed for use with Tungsten Carbide.

in place by a wedge having a corresponding taper, forming a positive lock that prevents loosening in the body. This construction is illustrated in detail at the left in Fig. 2. Hardened screws are used to hold the wedges in place. The use of hardened steel pins in the

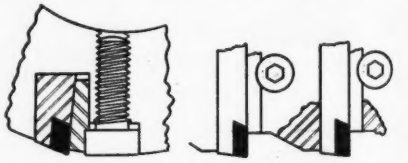

Fig. 2—Sectional view of body showing method of holding blades in place by a tapered wedge and screw; also a portion of the body illustrating how the tungsten carbide blades are solidly supported directly back of their cutting edges.

cutter body, which in turn fit into cross slots machined in the blades, eliminates the possibility of end slippage. One pin is used for each blade, but by having a series of five holes in each body slot and four cross slots in each blade, adjustments can be made in increments of $\frac{1}{16}$ in. This feature avoids the danger of having excessive overhang of the blades when re-adjustment of the entire set is made.

*Section removed to show position of tap in chuck

"Scully-Jones" Tap Chucks

For TAPS, DRILLS, REAMERS, WOODRUFF KEYWAY CUTTERS, END MILLS, Etc.

"DRIVE BY THE SQUARE — CENTER BY THE SHANK"

CENTER BY THE SHANK: Insure true running tools and uniform cutting action.

DRIVE BY THE SQUARE: Insure positive driven tools that can't slip.

MADE IN ONE PIECE: Simple, compact, no adjustments necessary, nothing to get out of order.

STOCK SIZES of "SCULLY-JONES" CHUCKS, ranging from No. 0 to No. 5 Morse Tapers, drive all size straight shank tools up to 1½" diameter, will be gladly sent on approval.

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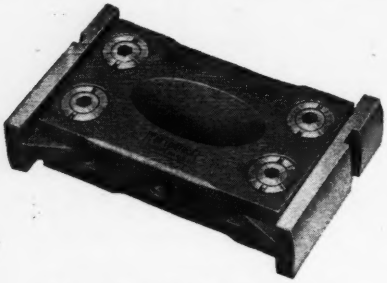
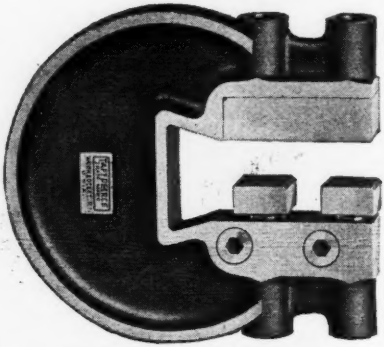
Taft-Peirce Flat Plug and Shoulder Snap Gages

The Taft-Peirce Manufacturing Company, Woonsocket, R. I., has brought out two new types of gages, one of which is an adjustable flat plug gage for measuring large internal diameters and the other, an adjustable snap gage for checking shoulder work. The flat plug gage incorporates all of the economies of adjustable gaging members. It consists of a well-designed and balanced body, shaped to fit the hand conveniently. The outstanding feature of the gage is the gaging members, which can be expanded, locked, and then reground to original size. The gaging members are made from a special hard steel which provides long wearing qualities and the interchangeable members can be replaced; hence the life of the gage is unlimited. An expansion of ⅛ in. is



T-P Adjustable Flat Plug Gage.



T-P Adjustable Snap Gage.

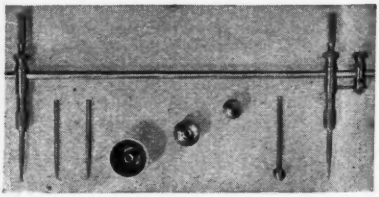
provided to allow a generous number of regrinds.

The adjustable snap gage is designed for checking flat or cylindrical work of plain sections or shoulder work up to a sharp corner as well. The adjustable member has two square anvils which can be set to any desired limits within its range. A newly-designed clamping device locks the anvils securely so that no variation is possible after sealing. The stationary member is rigidly bolted to the frame, which is especially designed for convenient handling.

Starrett No. 251 Trammels

Metal workers, draftsmen and others whose work demands precision in long measurements will be interested in a trammel now being manufactured by The L. S. Starrett Company, Athol, Mass. The new Starrett Trammel No. 251 presents a number of refinements and improvements. The beam is a steel rod, stiff enough to prevent the bending which often causes inaccuracy in wood-beam trammels. The beam is flattened on top so that the trams, once clamped in position, have no tendency to turn when pressure is applied to the points. As the illustration shows, one of the trams has an adjusting screw which permits extremely fine adjustments. The setting of the points is made easy by the arrangement of a spring friction which holds the trams in place when the nuts are loosened.

A major improvement which makes the new trammels more accurate and at



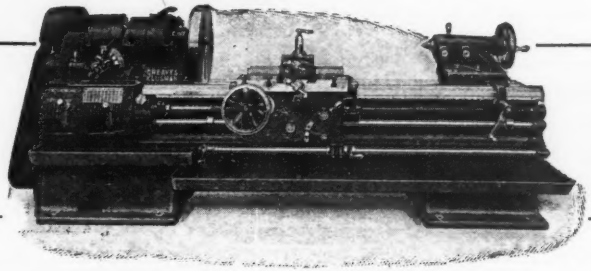
Starrett No. 251 Trammels.

the same time makes them easier to use consists in the design of the knurled grips. These are in the form of rollers which turn freely with the fingers as the arc is scribed. The trammel points are adjustable in the spring chucks. They can be replaced by pencils, caliper legs or ball points. The ball points permit working from holes up to 1½ in. in diameter. The Starrett No. 251

CORRECT TOOL PRESSURE ANGLE

That's Important, Too!

BUILT IN SIX SIZES



BELT OR MOTOR DRIVE

CORRECT tool pressure means that tool pressure will react on the inside of the front vee. The offset between the spindle center and the center line of the bed, on G. K. Single Lever Control Lathes assures you correct tool pressure angle on all work —even the larger diameters.

Correct tool pressure angle eliminates chatter, allows the lathe to be run at higher speeds and produces better work.

There are many more G-K Features described in the G. K. Catalog. Send for your copy today.

THE GREAVES-KLUSMAN TOOL CO., Cincinnati, Ohio

WHITON LATHE CHUCKS

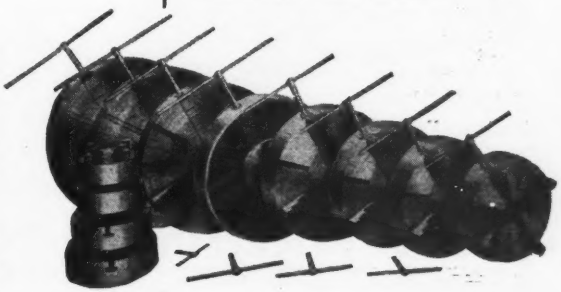
For a Sure Grip!

WHEN work must be held rigidly and securely for accurate machining at top speeds — WHITON Lathe Chucks prove their superiority!

WHITON Chucks—and there's one for every requirement—are good chucks. Their design and workmanship assure you dependable service over a long period of time.

Get a WHITON Catalog—it shows the complete line of WHITON Chucks as well as many special chucks built for special requirements.

Here is a group of WHITON Steel Body Independent Chucks designed to hold heavy work under heavy cuts at high speed. The one-piece body resists sudden strain.



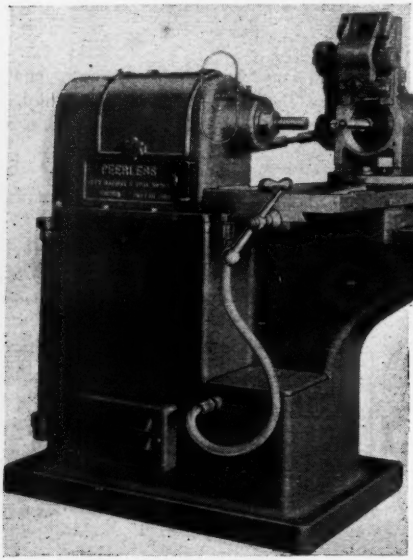
THE D. E. WHITON MACHINE CO.

NEW LONDON CONN.

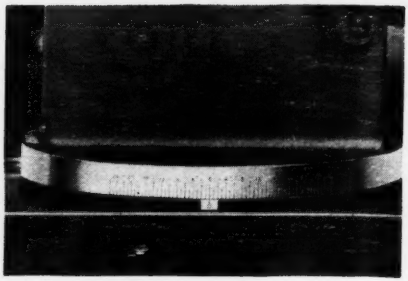
Trammel is supplied with steel beams of various lengths to scribe circles of 18, 26 and 36 in. diameter. In addition, an extra 20-in. beam with a rigid coupling is obtainable, increasing the range of the tool to circles 72 in. in diameter.

Peerless No. 3 Gear Tooth Chamfering Machine

The illustration shows the Peerless No. 3 Gear Tooth Chamfering Machine, which has been developed by the City Machine & Tool Works, East Third at June, Dayton, Ohio. The machine



Peerless No. 3 Gear Tooth Chamfering Machine.



The cylindrical base of the fixture head is graduated.

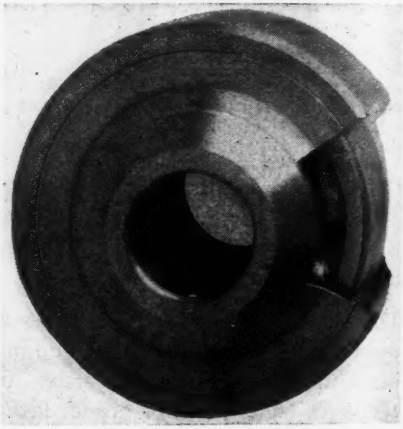
is similar in design to the other Peerless gear tooth chamfering machines built by this firm, with the exception that the No. 3 machine is much heavier and sturdier, is built with the knee integral in the base, has a fixed spindle mounting, and the fixture head is an integral part of the table. These features are intended to make possible greater production speeds with increased rigidity and a corresponding freedom from vibration.

The fixture head is made with a cylindrical base which is finished and graduated to facilitate setting the head at the proper angle to the cutter spindle. Another improvement consists in the design of the arm mechanism for moving the work back and forth to the cutter spindle; instead of the V's that are used on the smaller machines, a large cylinder is used, presenting a large bearing surface with an exceptionally strong arm to resist the increased wear and deliver satisfactory performance at heavier production speeds. The No. 3 machine offers all the flexibility as to

shape of chamfer, roundness, intermittent cutting, range of from 45 deg. to ball point, and ability to skip one or more teeth on a recessing or chamfering operation with which users of other Peerless machines have become familiar. A motor mounting is provided in the base of the machine, with adequate room for installation.

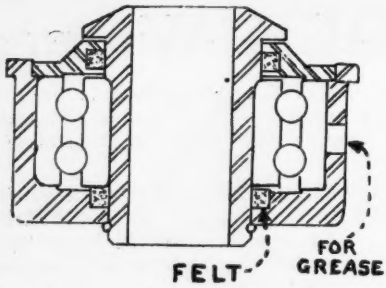
"National" Rotating Jig Bushing

A jig bushing that is built into a thrust ball bearing in such manner that the bushing rotates with the tool has been placed on the market by The National Boring Tool Co., 7625 E. Jefferson Avenue, Detroit, Michigan. The bushing was specifically designed for use with boring bars in which tungsten carbide tools are used, to meet the need for a bushing in which running clearance between the bar and the bushing could be eliminated so as to avoid vibration. This bushing can be made a "push" fit on the bar. Since the first bushings were placed in service, however, they have been applied on reaming operations where jig-bushing clearance must be



"National" Rotating Jig Bushing.

avoided and where the nature of the work is such that the ordinary type of bushing is subjected to severe punishment. The "National" bushing has been adapted for use in line-reaming fixtures where accuracy is the first consideration, in core-drill jigs where the irregularity of the cores subjects the bushing to hard wear, and in other operations



Cross-Section Drawing Showing Design of National Rotating Jig Bushing.

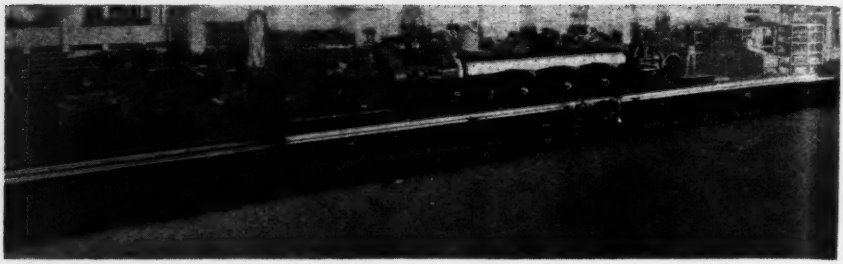
where the use of the bushing has made possible the elimination of intermediate or semi-finishing operations.

Norton Largest Grinding Machine

What is believed to be the largest grinding machine with a traversing table in the world has just been completed by Norton Company, Worcester, Mass., for the Southwark Foundry & Machine Co., Philadelphia, Pa. The machine will grind work up to 36 in. diameter by 288 in. in length and the limit of allowable weight is 40,000 pounds. It is said that the machine will grind to a mirror finish and easily within 0.0005 in. for concentricity and straightness. In a trial, the machine removed stock from a large cast iron column at the rate of six cubic inches per minute. The machine will be used principally for finishing rams and columns for mammoth hydraulic presses at the Eddystone Plant of the Southwark Company, and will permit finish grinding direct from rough turning, providing a better finish than was obtained by the methods used previously, in addition to a saving in time.

The machine is built on the same fundamental principles of design as all Norton cylindrical grinding machines. It is rigidly constructed so that despite the tremendous weight of the work being ground and the unusual length of the machine no vibration is caused.

The work is driven by a headstock which in this case has a live spindle 10 in. in diameter, in a ball bearing assembly that is 16⅛ in. in diameter. The head-



Probably largest grinding machine with traversing table in the world. Built by Norton Co.

stock is equipped with a chuck and the work is supported at the opposite end by a footstock provided with a regular center. These centers are 4½ in. diameter by 24 in. long, and are made of special alloy steel. The headstock and footstock are adjustable along a massive work table which weighs 16,448 pounds. The table was cast in a single piece to insure rigidity.

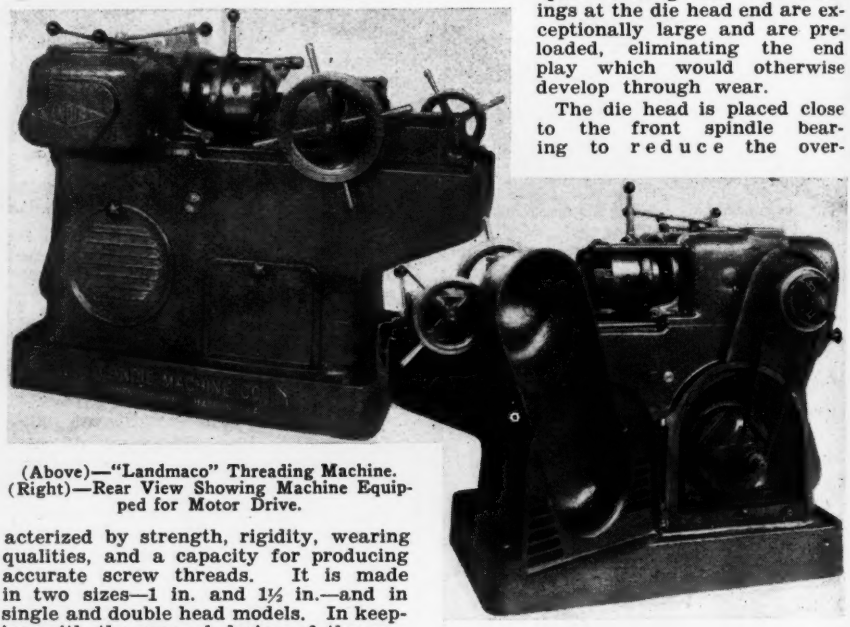
The wheel slide is massive, and is supported by large ways, one flat and one V-shaped, which are provided with forced feed "one shot" lubrication. The movement of the slide is accomplished by means of a large feed screw and a half nut which have been lapped together so that they act as an immense micrometer. In spite of the tremendous weight of the slide, the mechanism can be adjusted in position within 0.000125 in. Provision is also made for moving the wheel slide in and out rapidly by power.

The base is made in three sections, is 57 ft. long and weighs 36,755 pounds. Unusually large journal rests are provided for the machine, having a capacity of 30 in. diameter. A patented interlocking device is provided on the table

drive mechanism. Twelve speeds are provided for the work table. Motors required are one 30 h.p. motor for the wheel and table traverse and a 20 h.p. motor for the headstock.

"Landmaco" 1-In. and 1½-In. Threading Machine

The Landis Machine Co., Inc., Waynesboro, Penna., has placed on the market a threading machine to be known as the "Landmaco" threading machine. The machine is of a new design, characterized by strength, rigidity, wearing qualities, and a capacity for producing accurate screw threads. It is made in two sizes—1 in. and 1½ in.—and in single and double head models. In keeping with the general design of the machine, it will be equipped with heat treated and ground "Lanco" heads.



(Above)—"Landmaco" Threading Machine. (Right)—Rear View Showing Machine Equipped for Motor Drive.

The machine has a single pulley drive with a friction clutch to start and stop the machine. The clutch is adjustable and, as it is mounted on the outer end of the main drive shaft, it is readily accessible. The gear box is of the selective type and provides eight speeds, this wide speed range making possible the use of an efficient threading speed on all materials and for all diameters within the capacity of the machine. The gearbox is integral with the headstock and is fitted throughout with anti-friction bearings. The gears are made of hardened and burnished chrome nickel steel and are mounted on heat treated alloy steel shafts. Speed changes are effected through levers which are conveniently located and easily operated. The bearings and all gears are automatically lubricated by the flood system of lubrication.

The double head machine, when equipped with lead screws, has a reversing mechanism in the gear box for reversing one spindle. This mechanism can be supplied with the non-lead screw machines. The spindle is driven by spiral bevel gears. The bearings at the die head end are exceptionally large and are preloaded, eliminating the end play which would otherwise develop through wear.

The die head is placed close to the front spindle bearing to reduce the overhang to a minimum. The head is opened through a yoke by the forward movement of the carriage and is closed as the carriage is withdrawn, although the yoke also has a lever by which the die head may be opened or closed by hand. The carriage is gibbed and is operated either by a rack and pinion or a lever. The guides are completely protected by guards and wipers, the guards being attached to the front of the carriage so as to pass under the headstock. The wipers are located at the rear end of the carriage and are adjustable for wear. The guides are lu-

bricated automatically by felt pads which are located in the base of the carriage and are fed from a central oil reservoir.

The vise has horizontal sidewise as well as vertical adjustment, making possible an extremely accurate alignment between the die head and the work. This feature is distinctive to Landis machines. The heavy rim of the vise hand wheel acts as a flywheel and reduces the effort required to grip the work. The vise jaws are driven by bronze vise screw nuts which are renewable.

The pump, which is of the low pressure gear type, is connected directly to the constant speed shaft in the gear box and will reverse automatically when the machine is reversed. The pump is built into the bed and can be readily removed for inspection without disconnecting any piping. The bed is made of semi-steel and is cast in one piece. It is reinforced by an inner wall and forms a rigid support for the carriage and headstock. Large drains below the guides and also at the base of the bed return the cutting coolant overflow to the reservoir.

The leadscrew, which is optional, is located centrally between the guides of the machine and takes the thrust load without binding the carriage. It is mounted on large pre-loaded ball bearings which automatically eliminate end play. The lead screw has a coarse pitch thread with a rounded crest, this design not only facilitating the engagement of the nut, but greatly increasing the life of the unit. The lead screw is enclosed in a steel tube to protect it from chips and dirt.

The lead screw nut is of the split full-nut type and is made of bronze, each segment being made exceptionally long to increase its life. The lead screw nut has direct contact with and takes the thrust load of the carriage, relieving the carrier of all strain. A third adjustable half nut, also of bronze, is employed to take up the backlash. The contact surfaces of the lead screw and nut are lubricated automatically from a reservoir in the carriage. The supply is controlled by filtering the oil through a wooden plug in the lead screw nut.

The pitch change gears are housed in a gear box located at the headstock end of the machine. The intermediate gears are carried in a circular slot in the base of the gear box. This construction insures a rigid support for the entire gear train. The machine, when ar-

ranged for motor drive, has the motor mounted in a compartment in the bed and connected to the main drive shaft by a silent chain.

The Cleaning of Metal

A 76-page book recently published by the Magnus Chemical Co., Garwood, N. J., describes cleaning processes, methods and materials with practical suggestions for their use in the cleaning of metals. This book is well illustrated with drawings and photographs, and contains a glossary of technical words.

Angle Steel Stool Company Catalog M-S

The Angle Steel Stool Company, Plainwell, Michigan, manufacturers of steel equipment for the factory and office, announce a new 32-page condensed edition "Catalog M-S" which they will gladly mail to interested persons. The catalog contains a complete showing of the regular Angle Steel equipment line, besides the addition of some 30 new patterns that have been created to meet up-to-date demands. The catalog is 8½ x 11 in. in size, and contains detailed descriptions and prices.

A Correction

In the description of the J & L Model 21 Tangent die on Page 112 of the January issue of MODERN MACHINE SHOP, the statement was made that "They are then measured in the gage, Fig. 3, and a graduated microscope tells exactly where the cutting edge will be when the chasers are in the die." The word "microscope" should have been "micrometer screw."

Piece-Work System

(*Continued from page 48*)

scientiousness of the operator. He should do everything possible to induce the operator to be fair with him, and then, if he cannot gain the operator's confidence and co-operation, he should request that a new operator be furnished. An accurate time study can only be made when the operator has developed an even, rhythmic speed, which can be used as standard. An operator who deliberately attempts to retard the operation will immediately give evidence of his antagonism, as the rhythm will be lost and the time for the details of the operation will vary greatly.

Having decided upon the standard time for the operation, the next step is to set the piece-rate. In setting the rate, however, the question should first be settled as to the amount that the operator is to be allowed to make, and how much time is to be allowed out of each hour for personal contingencies (such as getting a drink, toilet, and so on). A common method of setting a piece-rate involves the use of the following formula:

$$\frac{R\ I}{A} \times S = P$$

In this equation R is the operator's hourly rate, I is the percentage of increase allowed as incentive (which is 125 per cent in the present instance), A is the number of productive minutes per hour expected, S is the standard time for the operation, and P is the piece-rate. Hence, assuming that the man's hourly rate is $.50 and the standard time for the operation is .45 minutes, the equation would be carried out thus:

$$\frac{\$.50 \times 1.25}{55} \times .45 = \$.0051$$

To explain: By adding 25 per cent to the man's hourly rate we get $.625. Dividing this figure by the number of minutes worked per hour (55) we get $.01136, or his earnings per minute. By multiplying this figure by the number of minutes required per piece (.45) we arrive at the piece-rate, which is $.0051, or approximately one-half cent. This formula can be used wherever a machine or bench operation can be standardized to the extent of obtaining an accurate timing. Where standardization is impossible, piece-work is not advisable and some form of bonus or premium should be applied.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Grinding Tungsten Carbide Tools: Instructions on grinding tungsten carbide tools, including directions as to angles, types, grades, and grains of wheels, wheel speeds, and so on, are included in a folder that can be obtained without charge by addressing Abrasive Company, Tacony and Fraley Streets, Philadelphia, Penna.

High Speed Tapping: The various types of Alto Motor-Driven, High Speed, Self-Contained Tapping Machines are described and illustrated in a series of folders that have been issued by The Alto Manufacturing Co., 1648-52 Wolfram St., Chicago, Ill. Free upon request.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

"Steelgrip" Universal Puller: Gears, wheels, or pulleys can be removed from shafts, regardless of the distance from the ends, by the aid of a puller that is made by Armstrong-Bray & Co., 668 Eagle Street, Chicago, Ill. Bulletin on request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

Sheet Metal Problems: The use of the nibbling machine for cutting sheet metal stock is discussed in a booklet which can be had without charge by addressing Andrew C. Campbell, Inc., Bridgeport, Conn.

Disc-Inspected Tool Steels: A bulletin discussing the advantages of disc-inspected tool steels can be had by writing to The Carpenter Steel Co., Reading, Penna.

Gears Of All Kinds are described and illustrated, with specifications, in Catalog 90, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

Mounted Grinding Wheels: Grinding wheels for use in small holes such as are to be found in bushings, dies, gears, etc., mounted and ready for use, are described in a bulletin that can be had by addressing the Chicago Wheel & Mfg. Co., 110 S. Aberdeen Street, Chicago, Ill.

Electric Tools: The complete line of "The Cincinnati" Electric Drills, Grinders, Buffers, etc., manufactured by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is fully described and illustrated in their new catalog. Free upon request.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Bolender Gear Burnishers: Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Columbia Superior Shapers: Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

Columbia Tool Steel Handbook: A book containing valuable information concerning the making of tools, heat treating, uses of hardness testing instruments, uses of the quenching bath, drawing bath, and other heat treating equipment, and together with tables and

OTHER PUBLICATIONS LISTED ON PAGES 114, 116, 118 and 120.

other useful information can be obtained without charge by addressing the Columbia Tool Steel Co., 550 E. 14th St., Chicago Heights, Ill.

Information For Broach Users: The Connecticut Broach & Machine Co., New London, Conn., has prepared a booklet listing the standards adopted by the S. A. E. covering the design of square, serrated or spline fitings, and including other information of value to the broach user. Copy free upon request.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Surface-Grind the Modern Way: Bulletin 635, issued by the Diamond Machine Co., 17 Codding St., Providence, R. I., tells the advantagees of modern, hydraulically-operated grinders, and describes the Diamond Type G Hydraulic Surface Grinding Machine. Copy free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Grooved Cast Iron Pulleys: All sizes of grooved cast iron pulleys, made by Efficient Machine Shop, 147 Baxter St., New York City, are listed in a circular that can be had by writing this firm.

"Ramet" Cutting Metal: A cutting metal which is neither a steel nor a composition of tungsten and cobalt, but which is said to cut alloy steels, manganese steel, or any other metal composition, is described in a folder that will be sent free upon application to Fansteel Products Co., Inc., North Chicago, Ill.

Lathe Turrets of eight different types and twelve sizes are described and illustrated in Circular No. 18, issued by Fay & Scott, Dexter, Maine. Copies free upon request.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Gear Chucks: Gears can be chucked from the pitch line by the use of a chuck that is made by the Garrison Machine Works, Inc., Dayton, Ohio. Descriptive booklet free upon request.

The Schaffner 11-in. Lathe is described and illustrated in a bulletin which can be obtained without charge by addressing The General Radial Drill Co., 1761 Elmore Street, Cincinnati, Ohio.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Take Care of Your Tools by keeping them in a convenient, strong, and fine-looking chest. A catalog of tool chests, complete with descriptions and illustrations, can be had by addressing H. Gerstner & Sons, 1283 Columbia Street, Dayton, Ohio.

Machine Vises of all sizes for use with machine shop equipment are described in a circular that will be sent free upon application to The Graham Mfg. Co., 69 Willard Ave., Providence, R. I.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Drawing Tables: The Hamilton steel-base, adjustable drawing table is described in Catalog No. 7-MS, issued by the Hamilton Mfg. Co., Two Rivers, Wis. Copy free upon request.

Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Texdrive Grinders for Vitrified or High Speed Wheels: A six-page bulletin No. 43 describes in detail and illustrates the advantages of the new Hisey Texdrive Grinder—stressing especially the multi-speed and single-speed machines. Write for a copy to The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, O.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 24 School Street, Boston, Mass. Copy free upon request.

Speed Reducers: A catalog of speed reducers up to 200 h.p. and built to deliver any ratio desired in standard size units can be obtained by addressing The Horsburgh & Scott Co., 5110 Hamilton Ave., Cleveland, Ohio. Give firm name.

Useful Tool Information: The Illinois Tool Works, 2503 N. Keeler Ave., Chicago, has published a catalog which describes and illustrates the standard and special cutters, mills, hobs, gear cutters, thread cutters, saws, reamers, and other tools made by this firm. The book also contains a number of useful tables and formulas. Copy free upon request.

Assembling with Electricity: Light, portable electric tools for drilling, tapping holes, and for driving screws are described in a booklet which can be had without cost by addressing the Independent Pneumatic Tool Co., 236 South Jefferson Street, Chicago, Ill.

OTHER PUBLICATIONS LISTED ON PAGES 112, 116, 118 and 120.

Special Mil-Waukee-Mils of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Keller Automatic Toolroom Machine for machining dies, metal patterns, jigs, core boxes, molds, and other irregular parts is fully described in a booklet that can be had free by addressing the Keller Mechanical Engineering Corp., 84 Front Street, Brooklyn, N. Y.

Koebel-Wagner Diamonds for Wheel Dressing: The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

Drill Around Corners: Holes can be drilled in close quarters by the use of the Koza Right Angle Drill. Can also be used for keywaying or counterairiking. A descriptive pamphlet can be had by addressing Chas. A. Koza, 464 Augustine St., Rochester, N. Y.

Threading Machinery: Catalog No. 32, containing full descriptions of Landis threading machines, stay bolt threading machines, bolt factory threading machines, automatic forming and threading machines and chaser grinders can be had without charge by addressing Landis Machine Co., Inc., Waynesboro, Penna.

Flexibility in Cylindrical Grinding means increased production, need for less equipment, and lower costs. Send for information as to the advantages of Landis Hydraulic Grinders. Address Landis Tool Co., Waynesboro, Penna.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Gears: Quick service on gears in either standard or special sizes is available from the Massachusetts Gear & Tool Co., 27 Nashau St., Woburn, Mass. Particulars upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Midwest Pin Drive Keyway Cutters are described and illustrated in a catalog that can be had by addressing Midwest Tool & Mfg. Co., 2362 West Jefferson Ave., Detroit, Michigan.

Polish at Any Speed: The Mitchell motor-driven polishing lathe, in which herringbone gears are used to transmit power from the motor shaft to the lathe spindle, can be operated at any desired speed. Bulletin can be obtained by addressing the Mitchell Engineering Co., Springfield, Ohio.

Monarch Stud Drivers: A stud driver that will set a stud tightly and then release easily is described in a circular that will be sent free upon request to Monarch Tool & Mfg. Co., 2704 E. Larned St., Detroit, Mich.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

"O. K." Tool System: The O. K. System for lathes, planers, shapers, boring mills, and other production machines consists of special forged steel holders with complete sets of tool bits of special design. Particulars can be had by addressing The O. K. Tool Co., Shelton, Conn.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

"Fastenings" is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

Use the Right Tool Steel for the Job: Full information as to the difference in tool steels and the correct grade of steel for each purpose is contained in a folder that has been issued by Poldi Steel Corp. of America, 245-247 West 18th Street, New York. Copy free upon request.

Do Your Bench Work on a Machine: Bench work that heretofore has been done by hand can now be done quicker, cheaper, and better on the P. & W. Vertical Shaper. Full particulars can be had by addressing Pratt & Whitney Co., Hartford, Conn.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procunier Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procunier tools play in obtaining greater accuracy and less tap breakage.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Rivett Plain Precision Bench Lathe: Bulletin 507-B, issued by the Rivett Lathe & Grinder Corp., Brighton, Mass., contains complete descriptions and illustrations of a bench lathe designed with plain bearings or with

OTHER PUBLICATIONS LISTED ON PAGES 112, 114, 118 and 120.

precision preloaded ball bearing headstock for tungsten carbide tool work. Copy free upon request.

Shape or Slot With This Machine: The Rhodes Convertible Shaper, made by The Rhodes Manfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

Pulimore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Hy Draulic Shaper-Planer: The most modern features are embodied in the design of the Rockford Hy-Draulic Shaper-Planer, which is intended for work that would otherwise go to the small planer or large shaper. Write for folder to Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Electric Tools: The complete line of "Ideal" electric drills, screwdrivers, nut setters, and grinders of various types is described and illustrated in Catalog No. 30, issued by The Schauer Machine Co., 907 Broadway, Cincinnati, Ohio. Copy free upon request.

Full Automatic Hobbing: Small pinions, gears, ratchet wheels, and similar parts can be hobbed economically on a full automatic hobber with magazine attachment. For full details write the George Scherr Company, 142 Liberty St., New York, N. Y.

Stamp Your Name on Your Product: Full information as to the steel roller dies made by The Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be obtained by writing this firm.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard-Niles Crane & Hoist Corp., 424 Schuyler Avenue, Montour Falls, N. Y.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard Niles Crane & Hoist Corp., 424 Schuyler Ave., Montour Falls, N. Y.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

Simplex Nesting Bins: Bins which may be used as individual containers, as tote-boxes, or "nested" to form stock-room sections are described in an illustrated circular published by the Simplex Tool Co., Woonsocket, R. I. Copy free upon request.

The Most Efficient Speed for the operation of special by the use of the WHS Speed Reducer and how it can production units, power conveyors, and other machinery be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

A Snyder Tool Set-Up, consisting of a Snyder ball-bearing multiple head, bushing plate, and work holding fixture, will convert a single spindle drill into a multiple drill at small cost. Particulars upon request. Address Snyder Tool & Eng. Co., 3400 E. Lafayette Ave., Detroit, Michigan.

Speed and Accuracy in Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue., Springfield, Ohio.

Accurate Gages Speed Production: The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Poughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

Machinists' Tools and Gages: Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

"Squar-It" Clamping Blocks will hold odd shapes and eliminate necessity for special jigs. Can be used on any machine. Write to Homer Strong & Co., Inc., Rochester, N. Y., for descriptive circular.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Snap, Plug, Ring, and Thread Gages: The complete line of precision gages made by The Taft-Peirce Manufacturing Co., 32 Mechanic Ave., Woonsocket, R. I., is described in a folder which can be obtained, free, by addressing this company.

Penetrating Oil for High-Speed Equipment: Three-In-One Oil, blended scientifically from animal, mineral and vegetable oils, will penetrate the tightest bearings and lubricate high speed units perfectly. Full information can be had by writing Three-In-One Oil Co., Dept. 96, 130 William St., New York, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 29, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Measuring Threads by Wires: Directions for micrometer gaging of screw threads by the use of wires are given in Circular W26, published by The Van Keuren Co., Watertown, Mass. Copies may be obtained free by addressing this company.

OTHER PUBLICATIONS LISTED ON PAGES 112, 114, 116 and 120.

Eliminate Clamping Time: Work can be held without clamps on grinders, planers, and other machines by the use of Walker Magnetic Chucks that are described and illustrated in a series of folders that have been issued by the O. S. Walker Co., Inc., Rockdale St., Worcester, Mass. Copies free upon request.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

Screw Machine Products: Full information as to the manufacturing service on screw machine products maintained by Western Screw Products Co., 19-31 St. George St., St. Louis, Mo., will be sent upon request.

Wetmore Adjustable Reamers: The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

Power Drive in Any Position: The modern flexible shaft makes it possible to drive all kinds and types of tools in places and positions impossible of access with straight-shaft machines. Ask The S. S. White Dental Mfg. Co., Industrial Division, 150A West 42nd Street, New York, N. Y., for the "Flexible Shaft Handbook." Copy free to any mechanical executive addressing this firm on his firm letterhead.

Whiton Steel Body Lathe Chucks: The various types and sizes of steel body chucks for lathes that are made by the D. E. Whiton Machine Co., New London, Conn., are described and illustrated in a booklet that will be sent free upon application to this firm.

OTHER PUBLICATIONS LISTED ON PAGES 112, 114, 116 and 118.

THE SCRAP PILE

By Geo. Alexander Mann

The average boy won't learn as much at his mother's knee as he will over his father's.

Troo Enuff

Our home brew is like
The sun at its best,
"It rises in the yeast
An' sets in the vest."

When in Rome most men do as the Romans do—unless their wives are with 'em.

Stuck Right

Couldn't move an inch,
Poor hapless bum,
He parked his Austin
On some chewing gum.

We read in Household Hints: "It's a weight off the mind of the bridegroom when he finds out that his wife can cook."

Huh—yeh, but isn't it better to have the weight on his mind than on his stomach?

"Takes Me" Is Right

We dine at swell cafes,
At eating she don't stint,
Gosh, she must take me
Fer an after dinner mint.

A man may lead a woman to the altar—but from there on it's her lead.

The more we hear o' the crooners the less we feel like shootin' the saxophonists.

Tuff Is Right

"Gosh, 'tis tuff," said Billy,
"I'm sure in great distress,
I been home so little,
I've lost my wife's address."

Sounds Like a Lotta Hooey

The optimistic cheer leaders shout us to be contented with our lot—Oh yeh-yah? Lot o' what?

Easy Street is named after the easy marks.

Musta Lost Her William

Lizzie left an order
With the florist on the hill,
She left a message with it:
"Just put it on my Bill."

The honeymoon is over when the broomstick takes up where the lipstick leaves off.

At the Christmas Dinner

"Do you wish a cocktail?"
He asked his pretty guest,
She said, "No, what I want
Is a piece o' breast."

Some o' the biggest liars are those who say the nicest things about you.

Index to Advertisements

FOSDICK

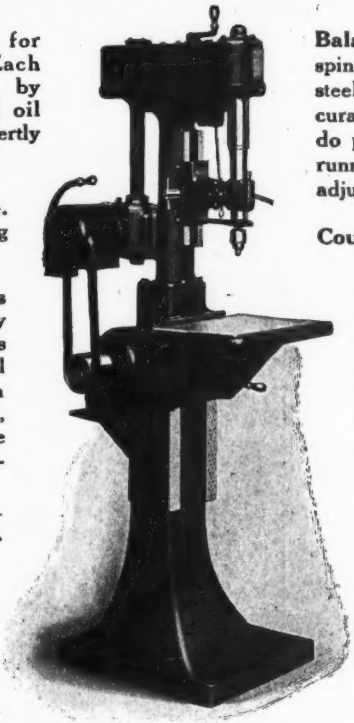
13" Superspeed Ball Bearing Sensitive Drill Will Reduce Your Drill Breakage

Ball Bearings for every journal. Each bearing protected by dirt-proof metal oil retainers and properly mounted.

Spiral Gear Drive. Spiral gears running in oil.

Running Parts Balanced. Every revolving member is balanced so that all vibration at high speeds is eliminated, and drill breakage is reduced to a minimum.

Speed Changes. The belt is shifted and speeds are changed by a single turn of the small handle on top. Belts can be replaced easily.



Balanced Spindle. The spindle is of high carbon steel, multiple splined, accurately ground, tested to do perfect alignment and running balance, and has adjustment to take up wear.

Counterbalanced Elevating Table. The elevating table is of the quick-acting counterbalanced type, with perfectly scraped slide gibbed to the pedestal. Handle at front of machine for clamping.

Counterbalanced Head. The head is gibbed to the doved-tailed slide on the column, and is counterbalanced to prevent dropping when unclamped.

Adjustable Feed Lever The feed lever is adjustable to various positions for convenience of operation. A quick return star wheel enables the operator to feed, return, or position the drill rapidly with either hand.

If you are looking for ways and means to cut costs, ask for specifications and prices on this machine.

THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.